

NEW DESMIDS

FROM

FINLAND AND NORTHERN RUSSIA

WITH CRITICAL REMARKS ON SOME KNOWN SPECIES

BY

ROLF GRÖNBLAD

WITH SEVEN PLATES

RECEIVED NOV 11 1921

HELSINGFORS 1921

NEW DESMIDS

AND THE NORTH-AMERICAN

FLORA

BY

JOHN

HELSINGFORS 1921

J. SIMELII ARVINGARS BOKTRYCKERI A. B.

To

Professor Fredrik Elfvig,

the first investigator of Finlandian Desmids,
whose suggestion led me to study these beautiful
microorganisms and who, in many ways,
kindly advised and assisted me,

I beg to dedicate these studies, as a sign
of indebtedness and gratitude.

Rolf Grönblad

During the time I have been occupied with the Desmids, a considerable amount of forms which could not be identified with any known Desmid was met with. Most of them (excepting the *Staurastra*, which will be published later on), are brought together in this paper. Moreover, there will be critical reviews of some species already known.

The samples are collected in many parts of Finland¹⁾ but also from adjacent parts of Northern Russia. My own collections were made at the following localities; Keuru (C); around Tammerfors in Messuby, Birkkala, Lempäälä, Teisko (W); Domargård near Borgå (S); Helsingfors (S); Björkö in Esbo skärgård (S); Jusarö in Ekenäs skärgård (S); around Viborg, Nyslott, Sordavala and Kexholm (SE).²⁾ Furthermore a very interesting collection of samples was given to me for examination by Prof. F. ELFVING including some from Åbo, Nådendal, &c (SW), and Helsingfors (S) collected by himself about 1875; further one from Räikälä near the Imatra Falls (SE) and two from Karkku (W) collected by HJ. HJELT; one from Ispois (SW) collected by O. M. REUTER at the same time; one from Kimito (SW) collected by H. WARÉN. Many samples from Esbo (S) and some from Åland (SW) were collected by Mr C. CEDERCREUTZ; some from Enontekis Lappmark (NW) by Mr M. KOTILAINEN; plankton from Vuoksen by Prof. K. M. LEVANDER. In 1918 I have

¹⁾ For the various parts of Finland are the following abbreviations used: (N)=Northern, (S)=Southern, (E)=Eastern, (W)=Western, (C)=Central-Finland.

²⁾ Collected during an excursion made in SW-Finland 1919. To the „Societas pro Fauna et Flora Fennica“ I am indebted for a pecuniary grant for this purpose.

also collected about 40 samples by an expedition in NW-Russia, Gouvernement of Archangel, around Uhtua and Hirvisalmi.

In conclusion, I want to express my hearty thanks to Dr O. BORGE, my honoured friend in Sweden, who gave me kind advice and assisted me on many difficult points. Furthermore I am deeply indebted to him for the two weeks spent at his home in Stockholm, where his very complete library and rich collection of Desmid-figures were placed at my disposal.

Helsingfors, September 1921.

Genus *Closterium* Nitzsch.

Cl. tumidum Johnson; West Mngr. I pl. 19 f. 15—18; var. *nylandicum*, nova var. Cellulae longiores apicibus plus attenuatis subtruncatis, saepe irregulariter curvatae. Locum medium inter *C. tumidum* et *C. cornu* tenens. Zygospora subrectangularis (saepe obliqua) lateribus longitudinalibus subrectis, lateribus transversalibus excavatis, angulis valde rotundatis non productis; a latere visa ovalis. Long. 100—200, lat. 8—11; zygospora long. 30—34, lat. 17—19 μ . [N:o 1129] ¹⁾

This variety differs considerably from the typical *C. tumidum* in being much longer and slenderer with more elongated and attenuated apices. It is distinguished from *C. cornu* by its thicker median portion. The zygosporer is much rounded at the angles, which are never produced. The copulating cells are always parallel and quite close to each other. Another allied species seems to be *C. acutum* Bréb. (vide Printz, Beitr. Norweg. pl. 1 f. 5.)

Hab. Björkö in Esbo (S). — Pl. 5 fig. 38—41.

Cl. pseudolunula Borge, N.-Amer. pl. 1 f. 2. Forma cellulis prae latitudine longioribus. Long. 239, lat. 38, apex circ. 9 μ . [N:o 952] — This form is longer and slenderer than the typical one. Moreover the pyrenoids are more numerous (6 in each semicell). Cell-wall entirely smooth but conspicuously yellowish coloured. Apex broadly rounded. Compare also *C. spetsbergense* Borge, Süssw. Alg. Spitzbg. pl. 1 f. 5, which is narrower at the truncate apices („sub

¹⁾ NB. The numbers in brackets [N:o] refer to my collection of original figures.

polis truncatis levissime constrictum"). Also very much resembles *C. spetsbergense* var. *australe* Playfair, Frw. alg. Lismore p. 319 [sec. auct. ips. synonym. $\equiv$ *C. lanceolatum* β *coloratum* (Klebs.) Playf., Sydney Desm. p. 604 pl. 40 f. 1.] which perhaps better could be united with *C. pseudolunula*.

Hab. Messuby (W). — Pl. 5 fig. 42.

Cl. spetsbergense Borge, Süssw. Alg. Spitzbg. pl. 1 f. 5, var. **laticeps**, nova var. Cellulae ad apices versus non tam attenuatae, apicibus latioribus levissime reflexis, margine ventrali plus concavo; pyrenoidibus in utraque semicellula 8—10 in unam seriem axilem dispositis; membrana plane glabra achroa. Long. 338—448—456, lat. 38—40—44, apex 9—9—11 μ . [N:o 863, 951].

Though this variety has a different appearance, I do not think it better to unite it with any other species.

Hab. Esbo (S) leg. C. Cz; Messuby (W). — Pl. 5 fig. 43.

Cl. lunula Ehr. Forma membrana subtilissime striolata, achroa. (Striae distincte visibiles cum „Leitz obj. $\frac{1}{16}$ homog. imm. $\times$ ok. III). Long. 669, lat. 87, apex 15 μ . [N:o 956] — I have examined a great number of specimens of this species by high magnification and I have found on the one hand entirely smooth forms (exceedingly minutely porose), on the other hand very finely and densely striate forms, the striation being well conspicuous by high magnification. I was not able to decide whether there were two distinguishable forms or only younger and older individuals. Only I would call the attention of the algologist to this fact, because *C. lunula* is always described as quite smooth.

Hab. Messuby (W).

Cl. rostratum Ehr. Zygospora monstrosa angulis protractis 3-dentatis. Long. cell. 228, lat. 19 μ ; zygospora $53 \times 68 \mu$. — The zygosporidium figured in West, Monogr. I pl. 26 f. 5 is not quite an accurate copy of Ralfs' figure (Brit. Desm. pl. 30 f. 3 e) in having truncate angles, whereas the angles are excavate according to Ralfs. Moreover the latter figure is not a good one, as the numerous zygosporidia which I have seen from different localities in Finland were

at the angles always bidentate as figured by De Bary pl. 5 f. 26 (and copied in Cooke, Brit. Desm. pl. 14 f. 3 c). [N:o 825].

Hab. The zygospore figured is from Gov. of Archangel. — Pl. 5 f. 44.

Genus **Euastrum** Ehrenb.

Eu. insulare (Witttr.) Roy var. **excavatum**, nova var. Semicellulae trilobae lobis basalibus non vel vix retusis, lobo polari dilatato profundiusque latiusque excavato. Long. 17,5 lat. 13, isthm. 3,2 μ . [N:o 881].

This form is very near to the form figured in West, Mngr II pl. 40 f. 12. It should also be compared with *Eu. tuddalense* Ström, Frw. alg. Telemark pl. 3 f. 2—4.

Hab. Amongst Utricularia, Gov. of Archangel. — Pl. 2 fig. 20—21.

Eu. elegans (Bréb.) Kütz. var. **ornatum** West, Mngr. II pl. 38 f. 26. The Finnish form is in front view almost identical with the English one, but in vertical view considerably thicker with more rounded subtruncate ends. Long. 43,6, lat. 25,1, crass. 20,5, isthm. 6 μ . [N:o 993 a].

Hab. Near Borgå (Domargård) (S). — Pl. 2 fig. 12—13.

Eu. lapponicum Schmidle, Pite Lappm. pl. 2 f. 29 (Syn. = *Eu. binale* f. Hirn, Desm. Finnl. pl. 1 f. 17). The granules of the centre of the semicell vary in number from 6 (as by Hirn) or 4 (as by Schmidle) to 3 or only 2. Long. 38, lat. 29, crass. 19, isthm. 8 μ . [N:o 1234].

Hab. Gov. of Archangel. — Pl. 2 fig. 14—15.

Eu. dubium Näg. var. **pseudocambrense** Grönbl., Desm. Keur. p. 30 pl. 6 f. 32—33. Membrana scrobiculis supra tumorem centalem binis ornata. Long. 34—36, lat. 25—26, crass. 16,5, isthm. 6—7,3 μ . [N:o 978].

Compare also *E. subglaziovii* Borge v. *minor* Borge, Regnell exp. pl. 4 f. 26; *E. binale* f. *lagoensis* Nordst., Desm. Brasil. pl. 2 f. 4; *E. abruptum* f. *minor* West, Desm.

U. S. pl. 16 f. 10; *E. abruptum* Ndt. l. c. pl. 2 f. 3 and Borge l. c. pl. 4 f. 23.

Hab. Messuby near Tammerfors (W). — Pl. 2 fig. 17—19.

Eu. turnerii West, Mngr. II pl. 37 f. 9—10, forma *fennica* nova f. Cellulis minoribus, in tumore centrali granulis 4 oblongis-arcuatis, supra eam utrimque scrobiculis binis ornata. Long. 37, lat. 29, isthm. 7,9 μ . [N:o 965].

Nearest to f. *bohémica* Lütke m. (Desm. Böhm. pl. 2 f. 2) Compare also „*Eu. sp. ad E. denticulatum et E. binale accedens*“ Nordst. (N-Zeal. pl. 3 f. 11), which form is already referred to this species.

Hab. Messuby near Tammerfors (W). — Pl. 2 fig. 16.

var. *karelicum*, nov. var. Cellulae lobo polari interdum cum lobis lateralibus fere confluenti. Lobi laterales non bipartitae sed dentibus tribus rotundatis (non acutis) triundulati, undula suprema ceteris maiore. Membrana supra tumorem centralem scrobiculis 4 (utrimque 2) perforata. Long. 40, lat. 28,5, crass. 16,1, isthm. 8 μ . [N:o 798].

Nearest to f. *bohémica* Lütke. and f. *fennica* nob. but sufficiently characterized by the lateral lobes. Compare also *E. denticulatum* β *elongatum* Nordst., N-Zeal. pl. 3 f. 10 *E. denticulatum* f. Ndt. ibid. pl. 3 f. 9.

Hab. Gov. of Archangel. — Pl. 2 fig. 22—23.

Eu. boldtii Schmidle, Beitr. Alp. Alg. pl. 16 f. 45. (Synon. = *E. denticulatum* f. Boldt, Desm. Grönl. pl. 1 f. 9). Bene cum figuris supra citatis congruens, sed granulis paucioribus. Long. 30—32, lat. 23—25, ist. 6 μ . [N:o 807 b].

I fully agree with Schmidle (Nuova Notarisia 1897 p. 64) in making Boldt's form a separate species. It is a well marked species not to be confused with *E. denticulatum* of which West thought it to be merely a common form.

Hab. Gov. of Archangel. — Pl. 2 fig. 10—11.

var. *isthmochondrum*, nova var. Cellulae minores tumore centrali granulis 3 (vel verruca subcirculari) ornata, ceterum serie simplici granulorum intra margines, praeterea

granulis maioribus singulis utrimque supra isthmum ornatae. Lobi laterales semicellularum margine granulis 3 acutiusculis armatae; lobi polares apice excavata, angulis spinigeris, marginibus lateralibus infra spinam leniter prominentibus. A latere visum percrassum apice latissime rotundata, tumoribus centralibus et granulis utrimque ad isthmum conspicue prominentibus. Long. 25, lat. 20, crass. 14,5, isthm. 5,3 μ . [N:o 1012 et 1126].

Though considerably differing from the type in the arrangement of the granules, I believe this form should best be referred to this species, the general outline of the cells being almost the same. Compare also *E. denticulatum* (Kirchn.) Gay and *E. subrostratum* West.

Hab. Hirvensalo (SW), leg. Elfv.; Domargård near Borgå (S). — Pl. 3 fig. 1—4.

Eu. pseudoboldtii, nov. sp. Cellulae parvae; semicellulae subquadratae lobis lateralibus aequaliter bidentatis; lobo polari apice medio retusa, conspicue dilatato, angulis non rostratis sed mucronatis; inferius sinu profundo a lobis lateralibus dissecto. Membrana in tumore centrali glabra, sed inferius supra isthmum granulis binis ornata; ceterum margines versus granulis nonnullis et utrimque sub impressionem apicalem granulis binis maioribus ornata. A vertice visae subovales polis non rotundatis, medio utrimque prominentia depressa. A latere visae subrectangulares apice crassa subrecta. Long. 22,4, lat. 16,5, crass. 9,9, isthm. 3,9 μ . [N:o 971].

This species is probably nearest to *E. boldtii* Schm. But I think it is quite sufficiently characterized by the lateral lobes, which are equally bidentate, whereas the lateral lobes of *E. boldtii* are rounded and acutely tridentate; likewise the deep sinus between polar- and lateral lobes is a very distinctive feature; the central protuberance is not so prominent and quite smooth.

Hab. Lempäälä near Tammerfors (W). — Pl. 3 fig. 5—7.

Eu. pulchellum Bréb., Liste pl. 1 f. 5 (West, Mngr. II

pl. 38 f. 14—15). var. **subabruptum**, nova var. Cellulae minores, prae latitudine longiores. Semicellulae apice vix rotundatae subtruncatae; lobo polari plus dilatato medioque incisura minus profunda introrsum rotundata extrorsum angulis acutis subaperta dissecto. Membrana in prominentia centrali granulis 3 quasi semicircularibus ornata ceterumque intra margines granulis emarginatis seu verrucis armata. Long. 31,7, lat. 21,8, crass. 14,5, isthm. 6,6 μ . [N:o 1009].

This variety resembles *E. abruptum* Ndt. on account of its dilated and abruptly truncated polar lobe and the more prominent lateral lobes. Within the polar lobe there are three emarginate granules or verrucae on each side; within the lateral lobes there are two equal granules and also two small simple granules on each side along the margins of the sinus, whereas the margins of the lateral lobes are furnished with 2—4 acutely conical granules; the central protuberance possesses 3 rounded granules. — Compare also Duce'llier, *Étude crit.* p. 62 fig. 38; *E. abruptum* Nordst., Desm. Brasil. pl. 2 f. 3 and Borge, Regnell exp. pl. 4 f. 23; „*E. binale*?” Borge, Archang. fig. 37.

Hab. Räikälä near the Imatra Falls (SE), leg. Hj. Hjelt. — Pl. 3 fig. 27—28.

Eu. denticulatum (Kirchn.) Gay; Ralfs, Brit. Desm. pl. 14 fig. 8 f. (sub. „*E. binale* var. β “); Gay, Monogr. loc. pl. 1 f. 7 (sub. *E. amoenum* Gay). This species has been crowded with a great number of various forms, which considerably differ from each other. It is a small species with a very delicate structure of the cell-wall, which cannot be clearly seen without a high magnification. The figures published are often very poor, drawn under a low magnification, the details in outline and especially in the arrangement of the granules being quite overlooked. These forms need a complete revision. — I have figured here a form which resembles *E. subrostratum* West (Madagasc. pl. 6 f. 6), which species perhaps could be united with *E. denticulatum*. Long. 28,4, lat. 21,4, isthm. 4,7 μ . [N:o 882].

Hab. Gov. of Archangel. — Pl. 3 fig. 8—9.

var. **angusticeps**, nova var. Lobo polari angustiore vix dilatato medio incisura introrsum acuta extrorsum aperta (angulis rotundatis) dissecto. Cellulae a vertice visae tumore centrali valde prominenti. Long. 25, lat. 20, crass. 12,6, isthm. 5,3 μ . [N:o 1013].

This variety is well characterized by its narrow polar lobe with a deeper and narrower median notch.

Hab. Hirvensalo (SW). leg. Elfv. — Pl. 3 fig. 10—11.

Eu. gayanum De Toni (syn. $\equiv$ *E. formosum* Gay, Monogr. loc. pl. 1 f. 9). Forma angulis basalibus non acutis. Membrana intra angulos granulis minimis ornata et in centro semicellularum tumore seu verruca armata. Long. 10,6—11,3, lat. 10,6—11,9, crass. 6,6—6, isthm. 3,9—4,6 μ . [N:o 1010 b, 1010 bb].

Perhaps *E. binale* f. Ström, Frw. alg. Telemark pl. 3 f. 6 is nothing but *E. gayanum*, the granulations being very delicate and difficult to distinguish. Compare also *E. binale* f. Schmidle, Pite Lappm. pl. 2 f. 24 (inf.); *E. sibiricum* Boldt.

Hab. „Isthmus karelicus“ (SE). — Pl. 3 fig. 12—15.

Eu. sibiricum Boldt, Sibir. chlor. pl. 5 f. 2; Johnson, New rare Desm. II page 292 pl. 239 f. 13. Forma **fennica** nova f. Angulis basalibus rotundatis glabris; angulis lateralibus et apicalibus spinulis parvis armatis; verruca centrali valde reducta, glabra; Long. 19,8, lat. 15,8, crass. 9,2, isthm. 4,6 μ . [N:o 1010 a].

Hab. Räikälä near the Imatra Falls (SE), leg. Hj. Hjelt. — Pl. 3 fig. 17—18.

forma **exsecta** nova f. Apicibus profunde exsectis, angulis basalibus minus rotundatis. — In this systematical form I have united two very slightly different forms, viz. a larger (long. 19,8, lat. 15,8, isthm. 6 μ) [N:o 1011] much resembling the f. *fennica* nob. and a smaller (long. 14,2, lat. 11,9, isthm. 3,1 μ) [N:o 883] with the margins of the apex and of the lateral lobes acutely granulate (resembling *E. denticulatum* in West, Mngr. II pl. 39 f. 3).

Hab. The larger form: Räikälä (SE), leg. Hj. Hjelt; the smaller: Gov. of Archangel. — Pl. 3 fig. 16 and 19.

Eu. binale (Turp.) Ehr. Forma lobo polari medio leniter retuso, angulis non acutis, sub margine apicali granulis 4 difficillime conspicuis ornato. Ceterum membrana glabra. A vertice visum crassum, medio utrimque tumore centrali haud multum prominenti sed tamen conspicua, polis subrotundatis. Long. 21, lat. 16,5, crass. 9,5, isthm. 4,6 μ . [N:o 1017].

This form should be compared with: *E. subincisum* Reinsch (Contrib. Alg. Bon. Spei pl. 6 f. 12); *E. laticolle* West (in Journ. Bot. 1912 p. 89 and fig. 6); *E. cosmarioides* v. *curtum* West (Singapore pl. 8 f. 18—19).

Hab. Karkku, leg. Hj. Hjelt. — Pl. 3 fig. 20—21.

Forma ad praecedentem accedens, sed minor, apice non granulato, a vertice visa cellulis minus crassis. Long. 15,8, lat. 13,2, crass. 7,3, isthm. 4 μ . [N:o 1023].

Compare also: *Cosmar. emarginulum* Perty; Racib., Desm. Poloniae pl. 4 f. 12; *Cosm. trilobulatum* Reinsch v. *depressum* Printz, Beitr. Norweg. pl. 2 f. 42; *Cosm. quadratulum* (Gay) De Toni; West, Mngr. III pl. 93 f. 4 a".

Hab. — (SW), leg. Elfv. — Pl. 3 fig. 22—23.

var. **pseudogutwinskii**, nova var. Cellulae parvae medio sinu profundo anguste lineari constrictae. Semicellulae subpyramidatae e basi recta, angulis basalibus rotundatis, lobis lateralibus 3-undulatis, lobo polari abrupte truncata medio incisura parva dissecto utrimque angulis dente parvo armatis. Membrana intra margines granulis nonnullis parvis ornata, in centro eminentia inconspicua scrobiculā conspicuā perforata est. A vertice visum anguste ellipticum, polis subacutis, medio utrimque eminentia minima. Long. 23, lat. 16,6, isthm. 3 μ . [N:o 832].

Very near to f. *gutwinskii* Schmidle, but is distinguished by the granulate cell-wall, the shorter polar lobe and the central scrobicula.

Hab. Gov. of Archangel. — Pl. 3 fig. 24—25.

Eu. bidentatum Näg. f. **biscrobiculata** D u c e l l., Desm. Suisse II page 127 f. 114. Our specimens agree quite well with the figure mentioned but are more granulate. Long. 53, lat. 34, isthm. 11 μ . [N:o 994].

Hab. Domargård near Borgå (S). — Pl. 3 fig. 26.

Eu. mononcyllum (Nordst.) Racib. var. **polonicum** Racib. f. **fennica** nova f. Margines lobi polaris spinulis binis utrimque in angulis lateralibus armatae; margines loborum lateralium granulis acutis 4—5; ceterum membrana granulis obtusis ornata. Long. 57, lat. 49, crass. (max.) 28, isthm. 15 μ . [N:o 973].

Hab. Messuby near Tammerfors (W); „Isthmus karelicus“ (SE). — Pl. 3 fig. 33—34.

The Finnish form agrees very well with var. *germanicum* Schmidle (Hedwigia 1894 pl. 1 f. 17) according to the outline of the cells and the general arrangement of the granules. The var. *polonicum* Racib. (Nonn. Desm. Pol. pl. 13 f. 6) is also very nearly related. Our form is distinguished from both these by the small spines at the angles of the polar lobe and the 4—5 acutely conical granules at the margins of the lateral lobes. In these respects it much resembles the spinate Nordstedtian form (= „a *capense* Rac.“). Whether these four forms (viz. var. *capense*, v. *polonicum*, v. *polon.* f. *fennica*, v. *germanicum*) really are distinguishable is not quite certain.

The spinate forms of *E. mononcyllum* very much resemble some forms of *E. spinulosum* Delp. Compare the following forms of *E. mononcyllum*: Borge, Sao Paulo pl. 5 f. 9; Nordst., Alg. Mus. Lugd.-Bat. pl. 1 f. 13; with *E. spinulosum*: Borge, Regnell exp. pl. 5 f. 4; Wille, Bidr. Syd-Amer. pl. f. 27; Gutwinski, Nonn. alg. nov. pl. 7 f. 67; Turner, E-Ind. pl. 10 f. 51; Raciborski, Nowe Desm. pl. 6 f. 6—7.

The most important distinctive features are:

E. spinulosum.

- 1) Polar lobe considerably dilated at the end.
- 2) Apex more retuse.
- 3) The incision between polar and lateral lobes narrow and acute.
- 4) The incision between the upper and lower lateral lobes acute or rounded.
- 5) Cell-wall spinate.

E. mononcyllum.

- | |
|---|
| <ol style="list-style-type: none"> 1) Polar lobe not at all or only very slightly dilated. 2) Apex only slightly retuse-emarginate. 3) The same incision widely open, rounded. 4) The same incision widely rounded. 5) Cell-wall spinate or granulate. |
|---|

By a comparison of the figures above enumerated with each other these differences seem to be of trifling importance. But it is, as I should think, better to keep these species separate than to unite them. — *E. mononcyllum* is not closely allied to *E. gemmatum*, to which it at first was referred as a variety, the vertical view of them being very different, and also the arrangement of the granules.

Most of the forms and species which belong here are tropical. A revision of the whole group would be very necessary.

Eu. verrucosum Ehr. var. **subplanctonicum**, nov. var. Robustius; lobo polari non dilatato; lobis lateralibus superioribus nullis vel ad minimum reductis, inferioribus latis. Protuberantia centralis magna, elliptica; laterales autem reductae. Membrana granulis permagnis armata. Long. 95, lat. 85, crass. 53, isthm. 21 μ . [N:o 997].

Hab. Domargård, Borgå (S). — Pl. 3 fig. 29—30.

Nearest to var. *planctonicum* West, Mngr. II pl. 40 f. 7 from which it is easily distinguished by the not dilated polar lobe, the shorter and broader lateral lobes and the much larger granules.

Eu. spec. — Only one semicell was seen. I therefore do not describe it as a new species. Possibly it is a

monstrous semicell of some known species. Long. semicell. 38, lat. 68, crass. 32, isthm. 15 μ . [N:o 1003].

Hab. Hirvensalo (SW), leg. Elfv. — Pl. 3 fig. 31—32.

Eu. insigne Hass. Forma lobis lateralibus sellaeformibus. Long. 144, lat. 64, isthm. 14 μ . — Compare also Wölle, Desm. U. S. pl. 26 f. 14; Hustedt, Tirol 1911 fig. 21; Borge, Beitr. Schwed. II f. 11; Dick, Desm. Südbayern pl. 14 f. 9. [N:o 866].

Hab. Esbo (S), leg. C. Cz. — Pl. 3 fig. 35.

Eu. didelta (Turp.) Ralfs. Forma angulis inferioribus conspicue oblique truncatis. Long. 148, lat. 84, isthm. 19 μ . [N:o 1006].

Hab. Hirvensalo (SW), leg. Elfv. — Pl. 3 fig. 36.

Eu. securiformiceps Borge, Desm. Regnell exp. pl. 4 f. 29; Sao Paulo pl. 5 f. 1. Agrees very well with the figures and description by Borge. The three small protuberances at the base of the semicell are not seen in his figures, but the vertical view (l. c. fig. 29 c!) shows that there must be some slight protuberances. The Finnish form possesses a little „nodule“ (thickening of the cell-wall) at the upper lateral lobes and the polar lobe. Long. 76, lat. 34, crass. 27, isthm. 10,5 μ . [N:o 1004].

Hab. Räikälä near Imatra (SE), leg. Hj. Hjelt. — Pl. 3 fig. 37—38.

This species has been suggested by West to be nothing but a form of *E. ansatum*. (Consult Journ. of Bot. vol. 50 page 86.) I cannot agree with him on this point, because no form of that species possesses such a broadly dilated convex apex; even the side view is quite different. I therefore think Dr Borge was right in describing it as a new species.

Eu. aboense Elfv. Anteckn. Finska Desm. pl. 1 f. 2; West, Mngr. II pl. 36 f. 5—6; Duce'llier, Étude crit. 1914 page 49 f. 25 a—c, 26 (sub. nom. *E. aboense* var. *nodulosum* Duce'll. et var. *laeve* Duce'll.).

The characteristic features on which Duce'llier founded his „var. *nodulosum*“ are also constantly present in the

original specimens of Elfving, from which our figures are made. This is not mentioned in the diagnosis by Elfving, which consequently is not quite accurate. Also with regard to another point the diagnosis must be altered. The cell-wall is described as „grosse punctata fere granulata granulis majoribus (vel ocellis) circiter 12 plus minus concentrice dispositis“, although the cell-wall is not at all granulate, but, on the contrary, delicately punctate (= porose), generally with 11 (sometimes more or fewer) symmetrically arranged scrobiculations. Also West's form (= v. *laeve* Duccell.) is, I think, nothing else than the typical one. — Long. 65, lat. 40, crass. 27, isthm. 11 μ . [N:o 1092].

Hab. Ispois (SW), leg. O. M. Reuter. — Pl. 3 fig. 39—40.

Genus *Micrasterias* Ag.

M. decemdentata (Näg.) Arch.; Nägeli, Gatt. einz. Algen. pl. 6 H, fig. 2 (syn. = *M. itzigsohnii* Braun in Bréb., Liste Desm. Normandie pl. 1 f. 2 page 121). The species, as described and figured by more recent authors, does not quite agree with the figure published by Nägeli (perhaps better with his description), especially with regard to the shape of the polar lobe.

M. itzigsohnii Braun l. c. is not a form of *M. truncata*, as suggested by West (Alg. Notes V—IX pag. 23 fig. 3 A), but seems to be identical with *M. decemdentata*.

M. incisa Bréb. (syn. *Euastr. crux melitensis* Ehrbg., Infus. Pl. XII quoad fig. III c!) most probably belongs to the same species as *M. decemdentata*. This suggestion is supported by a figure published by Playfair (Plankt. Sydney W. S. pl. 54 f. 31 as „*M. truncata* v. *decemdentata* $\times$ v. *incisa*, f. *mixta*“).

M. neodamensis Braun 1856 in Rabenh. exsicc. n:o 508 is twice the size of *M. decemdentata* and it is surely only a form of *M. truncata* which it resembles with regard

to size, polar lobe, lateral lobes, and also vertical view. I have here published two figures of original specimens. (Pl. 3 fig. 61—62). Mr. Itzigsohn says in his announcement of the „Liste Desm.“ by De Brébisson (cfr. Botan. Zeitung 1856) as follows: „Die aufgeführte *M. itzigsohnii* Braun Mss. ist von mir unter den Namen *M. neodamensis* A. Br. (Dec. LI und LII Nr. 508) in Rabenhorst's Algen Sachsens &c 1856 vertheilt worden.“ But this is not quite correct because *M. neodamensis* is a form of *M. truncata*, but *M. itzigsohnii* is a form of *M. decemdentata*. The specimens distributed in Rabenhorst's exsicc. Nr. 508 do not at all agree with the figure by Brébisson.

M. truncata (Corda) Bréb., the typical form: West, Mngr. II pl. 42 f. 2 and 7; Borge, Sao Paolo pl. 5 f. 24; Stange, Micr.-formen fig. XVI: 1—2, XVII: 4—5. The type considerably differs from *M. decemdentata* and should on no account be confused with this species. *M. truncata* is twice the size; the distance between the isthmus and the basis of the polar lobe is nearly twice the length of the polar lobe, but in *M. decemdentata* these distances are of equal length. In *M. decemdentata* the lobules are furnished with real spines (very constantly and characteristically), which are longer, narrower and sharper than in *M. truncata*, in which the ultimate lobules are often emarginate, but not spinate. Moreover *M. decemdentata* is distinguished by its polar lobe which has a straight (or nearly straight) apex, with the angles suddenly drawn downwards and each furnished with one distinct spine directed horizontally or downwards. Polar lobes of an almost similar shape occur also in certain forms of *M. truncata* especially in those belonging to var. *crenata* or nearly related to this variety. The difference which commonly has been pointed out as characteristic is the size of the cells, but it exists only as long as we compare the typical forms, because there are gigantic forms of *M. decemdentata* with typical cell-form (cfr. Wolle, Desm. U. S. pl. 33 f. 5—6 pag. 113; length = 83—100 μ ; Playfair, Sydn. Desm. pag. 608: length = 88—120 μ), as

well as dwarf forms of *M. truncata* with perfectly typical cells (cfr. Borge, Sao Paulo p. 66: length 55—65 μ ; Wolle, Desm. U. S. p. 114: length 50—100 μ „var. *minor* Wolle“; Lagerheim, Amer. Desm. p. 230: length 42—44 μ „v. *minor* Wolle“). The typical *M. truncata* is in Finland commonly more than 100 μ (90—115), in England (cfr. West, Mngr. II p. 83) it is 87—138 μ .

In Finland *M. decemdentata* has not been recorded earlier. — [Elfving has (Desm. Finl. pl. 1 f. 1) figured an abnormal *Micrasterias* in which one semicell is typical of *M. pinnatifida*, whereas the other resembles var. *inflata* Wolle (Desm. U. S. pl. 37 f. 9) or f. *quadrata* Turn., (E.-Ind. pl. 5 f. 3b). Thus the author is not right in saying: „altera semicellula characteres *M. incisae*, altera *M. pinnatifidae* praebet.“; and *M. incisa* therefore is not known to have been found in this country.] — I have seen this species from only two localities in SE-Finland and it is one of our rarest *Micrasterias*. Long. 46—51, lat. 51—60, crass. 14—16, isthm. 9 μ . N:o 1283].

Hab. Antrea (SE). — Pl. 1 fig. 1—3.

M. truncata (Corda) Bréb. and var. *crenata* (Bréb.) Reinsch.

These forms, originally described as two separate species, have been united by several authors, the former always being regarded as the type and the latter as a variety of this. Already Ralfs (Brit. Desm. p. 75—76) expressed this view, later also Archer (Q. J. M. Sc. n. s., vol. 5, 1865 pag. 257). The first who really united them to one species was Reinsch (Alg. Flor. Frank. 1867 pag. 143—144); also Rabenhorst (Flor. Eur. Alg. III p. 191); Cushman (New Engl. Micrast. 1908 p. 102); Cedergrén (Arkiv f. Bot. 1913 p. 16—17); Borge (in litt. 4/5 1919). Contrary to these authors Mssrs W. and G. S. West (Mngr. II p. 86) are pointing out the considerable difference between typical specimens of *M. truncata* and *M. crenata*; but they also admit the existence of many transitional forms. According to the description given by West *M. crenata* should

have the margins of the ultimate lobules rounded or retuse (not bidentate) and so, without spines, it is considered by most authors. Again, Ralfs described *M. crenata*: „lateral lobes are sometimes entire, but more usually crenate, occasionally having a few inconspicuous teeth“, and he also figured it as such (l. c. pl. 10 fig. 4 b). Also Delponte (Desm. subalp. pl. 5 f. 17—18) figured *M. crenata* furnished with acute spines at the margins. But Delponte added to his form a mark of interrogation, and in fact the margins much more resemble *M. truncata* from which is distinguished only by its higher polar lobe. I have never seen such a form.

Like West I have very seldom seen *M. crenata*. But many transitional forms occur. *M. truncata* seems to be much more variable in Finland than in England, so, that one may frequently find forms which just as well could be regarded as belonging to both species. Therefore I would prefer to unite these forms in one species as *M. truncata* type and var. *crenata* (Bréb.) Reinsch.

The typical *M. truncata* is figured by West (Mngr. II pl. 42 f. 2 and 7); Stange (Micr.-formen, fig. XVI: 1—2, XVII: 4—5); and also the typical cell-form by Borge (Sao Paolo pl. 5 f. 24). A slightly different form is *M. neodamensis* Braun in Rabenhorst, Exsicc. N:o 508), which neither with regard to shape, nor to size, can be distinguished from e. g. some of the forms figured by West (Mngr. II pl. 42 f. 3 and pl. 45 f. 5).

Hab. The type is common in all parts. — Pl. 1 fig. 4—5, 8, 11; — the var. *crenata* is exceedingly rare; only in Gov. Archangel. — Pl. 1 fig. 7.

var. **quadrata** Bulnheim (in Hedwigia 1859 pl. 2 f. 2); Rabenh. exsicc. N:o 1224! This variety consists of a group of forms, which very constantly and characteristically differ from all other forms (— also from v. *crenata* —). The most important and distinguishable characters are: the very thick habit (also „a vertice“), the closed and less deep incisions, the highly arched polar lobe (as in *M. crenata*)

the commonly 5- (sometimes 2—7-) spinate or dentate upper and lower lateral lobes, which are not divided into sublobes. — A synonym to this variety seems to be *M. crenata* by Stange (Micr.-formen, fig. XV).

Long. 103—106, lat. 91—103, crass. 49, isthm. 19—25 μ . [N:o 809 a].

Hab. Keuru (C). — Pl. 1 fig. 9—10.

var. **semiradiata** (Kütz.) Cleve; Nägeli (Gatt. einz. Alg. t. 6 f. H 3). The species described by Nägeli is nothing but a form of *M. truncata*. Whether this form should be separated as a systematic form is somewhat doubtful, as there are also transitional forms. But the original form, as described by Nägeli, seems to be so characteristically distinguished by the shape of its polar lobe and by the longer and slenderer spines at the margins of all lobes, that it could quite well be separated as a systematic form: var. *semiradiata* (Kütz.) Cleve. The schematic figure of *M. truncata* var. *semiradiata* given by Wolle (Desm. U. S. pl. 38 f. 7) also agrees with the original figures; *M. truncata* in Wittr. & Nordst. exsicc. N:o 373 (collected by Wolle in North-America!) is likewise the same form. The latter form at least is considerably smaller than the type. (I have measured: length 64—74—76, breadth 80—84, isthm. 13—13 μ). The isthmus is almost half the size. — [N:o 903 c]. — Pl. 1 fig. 6.

In Finland I have observed a form which considerably resembles the variety mentioned above, but it is much larger (length 103—116 μ) and it is closely related to the form figured by Printz (Beitr. Norweg. pl. 1 f. 11), which is very large: length 124—128 μ .

The whole group of forms, called *M. truncata*, includes so many different forms, always with continuous series of intermediate forms, that it is not possible to make up a system of them.

M. crux melitensis (Ehr.) Hass. This species seems to vary far more in Finland than e. g. in England if one is to judge from the Monograph by West. Besides the var.

janeira (Rac.) Grönbl. and var. *protuberans* Grönbl. Desm. Keur. there is a form much resembling the latter and not seldom met with. It has a high polar lobe with widely outstanding lobules and lateral lobes with long outdrawn basal lobules nearest to the sinus.

Hab. Lempäälä near Tammerfors (W). — Pl. 1 fig. 16.

M. radiata Hass. A very curious monstrous semicell resembling *M. ceratophora* Jösh. was observed.

Hab. Keuru (C). — Pl. 1 fig. 12.

M. sol (Ehr.) Kütz. Also this species is very variable. An unusually large form of var. *ornata* Ndt. was observed (length = breadth = 228 μ).

Hab. Keuru (C).

M. murrayi W & G. S. West. It must be considered as very doubtful whether the species of West really can be clearly distinguished from various forms of *M. sol* var. *ornata* Ndt. These seem to me to be so nearly related in all respects that I should think it might be better to unite them in one species. The Karelian form generally quite well agrees with the English, but especially the sinus between the two semicells is much less open. The rest of the peculiarities of this species, viz. the concave sides and the less depth of the incisions, the absence of the further subdivision of the superior lateral lobes are also met with in *M. sol* var. *ornata*; likewise I have observed forms of this species with a broadly dilated polar lobe. — Length 156—158, breadth 144—145, isthm. 16—18, l. pol. lob. 60, br. pol. lob. (apex) 44 μ .

Hab. Gov. Archang. — Pl. 1 fig. 13.

M. rotata (Grev.) Ralfs. Even this species varies very much in Finland. It is only seldom that I have seen forms thoroughly agreeing with the figure given in West's Monograph II pl. 48 f. 1. Moreover I have never seen specimens with such thick cells „a vertice“ as shown in the figure 4 by West (copied from Mr Archer). The relation between the breadth and the thickness of the cells should be about 3,3 but I have measured 4,4; moreover, I have

always in the middle of the vertical view („a vertice“) found a distinct but flat tumidity. — Vide Pl. 2 fig. 1 and 2! — Various forms observed by me agreed with the following figures: f. *evoluta* Turn., E.-Ind. pl. 23 f. 1; Duccellier, Desm. Suiss. II pag. 136 pl. 3 f. 1 and 3; Stange, Micrast.-Formen fig. IX: 4—5, 7, 10. In a sample from Russian Karelia was found a mass of *M. rotata* of various forms, but without exception possessing a polar lobe which stands high above the lateral lobes. Cfr. Wolle, Desm. U. S. pl. 34 f. 1—3. Another sample, also from Russian Karelia, contained various forms of *M. rotata*, which all had a strong resemblance to *M. quadridentata* (Nordst.) Grönbl. (cfr. Desm. Keur. page 35—36); Wittr. & Nordst. exsicc. No 371; Borge, Sao Paulo pl. 5 f. 33. But I do not think there is any reason for uniting my forms with *M. quadridentata*, which is an easily distinguished gigantic tropical species. (Cfr. Wittr. & Nordst. exsicc. fasc. 21 p. 35. — „length 335—360 μ “; — I have myself measured 372 μ .) — ¹⁾ Both the typical *M. rotata* and this Karelian form are very variable and between these there are many intermediate forms. The features of this characteristic form are: a polar lobe which stands more or less high above the lateral lobes; the margins of the ultimate lobules are very variable but commonly broadly 2—4-dentate as in *M. quadridentata*; and finally, the perhaps most important of peculiarities viz. the upper and the lower lateral lobes are of equal breadth, each of them being subdivided into 4 ultimate lobules (as in *M. quadridentata*), whereas in the typical *M. rotata* the upper lateral lobe is always broader than the lower. I now think it will be best to place our form as a „forma **pseudo-quadridentata**, nova f.“ of *M. rotata* with the following diagnosis:

Semicellulae trilobae, lobo polari prominenti, lobulis ultimis acute bidentatis; lobis lateralibus inferioribus superioribusque aequilatis bis dichotomis segmentis ultimis truncatis

¹⁾ Vide our Pl. 1 fig. 14—14'.

late 2—4-dentatis; tumoribus basalibus nullis. Long. 228—274—277, lat. 213—236—247, isthm. 34, long. pol. lob. 64—72. — Pl. 1 fig. 15.

Finally I have seen a form which might be f. *evoluta* Turn., but the spines of the ultimate lobules are, very characteristically, quite tangentially directed. Long. 281, lat. 251 μ . — Pl. 1 fig. 17—18.

M. denticulata Bréb. and some allied species.

This species and its nearest relatives viz. *M. thomasi* Arch., *M. angulosa* Hantzsch, *M. verrucosa* Biss., have been identified in quite different ways by different authors. The reason for this is that the figures published commonly were very inaccurate, but also that the number of the various forms is very considerable. If I shall not be able now fully to clear up this question, I think these remarks might be of some value in stimulating other algologists to further study of these forms.

The typical *M. denticulata* ¹⁾ has all lobules with rounded angles, not acute or spinate. (Ralfs, Br. D. p. 70 pl. 7 f. 1; De Toni, Sylloge I p. 1130; West, Mngr. II p. 105 pl. 49 f. 1—6 and pl. 50 f. 1—2). Across the base of the semicells are three flattened rounded protuberances. Such a form at first very much resembles *M. angulosa* ²⁾ (in West: *M. denticulata* var. *angulosa*) from which it is easily distinguished by its longer (commonly more than 70 μ) polar lobe with its concave sides, whereas *M. angulosa* always has a very short polar lobe (from 42 to 62 μ at most). The best differential character is seen in the vertical view: *M. denticulata* with strongly undulated margins (corresponding to the basal protuberances in front view), whereas *M. angulosa* in vertical view is not undulated but at the middle very thick, so that it becomes the shape of a flattened rhomboid. *M. angulosa* is a well characterized species and should not be confused with *M. denticulata*.

¹⁾ Vide Pl. 2 fig. 6—7.

²⁾ Vide pl. 2 fig. 4—5.

M. denticulata includes not only such forms as have the ultimate lobules rounded, but also many denticulate forms, which have been described by various authors. Such forms are intermediate between this species and *M. thomasi* and, in my opinion, they would with the same right or perhaps better be placed in *M. thomasi*. The way that these two species are now defined seems to me quite artificial. But to refer all forms with denticulated margins to *M. thomasi* so that *M. denticulata* would include only not-denticulated forms, would perhaps be a more natural arrangement. — (But on the other hand two closely allied forms viz. *M. dent.* v. *intermedia* and *M. dent.* forma Hirn, would then be referred to different species!)

var. *intermedia* Nordst.; Wittr. & Nordst. exsicc. N:o 370; Borge, Sao Paolo pl. 8 f. 11. This form already considerably differs from the typical one with its denticulate margins and the more numerous and more prominent protuberances. The denticulate margins resemble *M. thomasi* (inclus. var. *notata*), but in that species the ultimate lobules are slenderer with longer denticulations. On the other hand this form resembles *M. verrucosa*, in which the protuberances are also numerous, but less prominent, and the marginal denticulations are less developed and irregular. All these forms possess a slight but very characteristic feature, viz. the ultimate lobules are narrowed outwards with conspicuously convex sides and it seems as if the two denticulations on each lobule were a little convergent. — The var. *intermedia* possesses a broader polar lobe with a less retuse apex than the type. — Pl. 2 fig. 3.

Old semicells of *M. denticulata* sometimes become coarsely granulate and rough, whereas the younger ones can be quite smooth or delicately punctate. Such a form has been figured by Petkoff (Period. Spisan.¹ 59, 1899 pl. 4 f. 69) erroneously as „*M. rotata*“.

M. denticulata f. Hirn (Desm. Finl. pl. 1 f. 22) is intermediate between the type and var. *intermedia* but should be referred to the former on account of the smooth margins.

M. denticulata in Wittr. & Nordst. exsicc. N:o 1454 a is a form of var. *intermedia*, intermediate between this and *M. thomasiana* v. *notata*, (whereas *M. denticulata* in Wittr. & Nordst. exsicc. N:o 552 is nothing but a reduced form of *M. thomasiana*).

Very closely allied to *M. denticulata* v. *intermedia* is *M. verrucosa* Biss. If in a fluid under a covering glass these two forms of *Micrasterias* scarcely can be distinguished from each other; only the margins of the former are more conspicuously denticulated than in the latter. But if the objects are studied without a covering glass in very little fluid, all the protuberances become quite conspicuous, and under a high magnification one is able to perceive even the characteristic granulations of *M. verrucosa*. Perhaps *M. verrucosa* should be classed as a variety of *M. denticulata*, but on the other hand the granulations are such a characteristic feature — as the elongated protuberances in *M. thomasiana* — that I did not think it necessary to unite them.

M. thomasiana Arch. This species also varies considerably the most reduced forms being very closely allied to the var. *intermedia*-group of *M. denticulata*. Jacobsen made of it (1875) a „f. *thomasiana*“ of *M. denticulata*. But this was not a good arrangement and has not been adopted by other algologists.

I have not seen any specimens from Finland either of typical var. *notata* Ndt., or of var. *subnotata* West. A form with 4 small subapical notches on the polar lobe will be figured here. — Pl. 2 fig. 8—9.

Genus *Cosmarium* Corda.

C. cedercreutzii, nova spec. Cellulae subparvae medio sinu anguste lineari non profunde constrictae. Semicellulae subrectangulares ad apices versus paullum angustatae, lateribus convergentibus 4-undulatis, apice truncato recto 4-

undulato; angulis basalibus vix, apicalibus valde rotundatis. Membrana intra margines granulis depressis seu „undulis“ regulariter in series 9 radiatim exeuntes et simul in series 2—3 concentrice dispositis, praeterea utrimque ad isthmum serie simplici granulorum 4 ornata. A vertice visum crasse rhombiforme angulis obtuse rotundatis. Long. 26, lat. 20, crass. 15, isthm. 12 μ . [N:o 1120].

Compare also *C. sexnotatum* Gutw., Flor. Glon. Galic. III pl. 3 f. 7; *C. tetragonum* Näg. formae; *C. grantii* Roy & Biss., (West, Mngr. III pl. 91 f. 11); *C. crenatum* var. *alpinum* Racib., Nonn. Desm. Pol. pl. 2 f. 11; *C. undulatum* v. *minutum* Wittr., Skand. Desm. pl. 1 f. 3.

Hab. Esbo (S), leg. C. Cz. Pl. 6 fig. 12—13.

C. calamistratum, nova sp. Cellulae subparvae sex-angulae medio sinu anguste lineari modice constrictae. Semicellulae pyramidatae lateribus 4-undulatis, apice truncato 4-undulato angulis non rotundatis. Membrana intra margines undulis regulariter in series 12 radiatim exeuntes et simul in series 5 concentrice dispositas, praeterea supra isthmum granulis parvis et depressis 9 (in series 3 transversales et 3 longitudinales) ornata. A vertice visum oblongum medio utrimque tumidum. Long. 22,4, lat. 21, crass. 13, isthm. 10 μ . [N:o 1052].

Compare also *C. cedercreutzii* nob., supra; *C. crenatum* Ralfs.

Hab. Helsingfors (S), leg. Elfv. Pl. 6 fig. 14—15.

C. pseudopromontorium, nova sp. Cellulae parvae sinu anguste lineari modice constrictae. Semicellulae subrectangulares lateribus biundulatis (cristis 3 inclus. angulis apicalibus, impressionibus 2) cristis verruciferis, angulis non rotundatis, sub apice profundius excavatae; apicibus truncatis rectis vix conspicue levissime 4-undulatis angulis bigranulatis (seu verruciferis). Membrana intra margines serie simplici granulorum 8 et in medio semicellularum verruca parva 4-granulata ornata. A latere visae semicellulae circulares medio utrimque prominentia parva. Long. 13,2, lat. 11,9, crass. 7,9, isthm. 5,3 μ . [N:o 1122].

This species should be compared with *C. promontorium* West, New Brit. Frw. alg. pl. 1 f. 14; *C. humile* (Gay) Nordst., West, Mngr. III pl. 85 f. 16—18; *C. subdanicum* West, Mngr. III pl. 85 f. 25—26.

Hab. Gov. of Archangel. — Pl. 6 fig. 22—23.

C. Blyttii Wille var. *pseudorichmondiae* nov. var. Forma cellularum eadem fere atque in var. *richmondiae* Playf., Biol. Richm. Riv. pl. 3 f. 12 sed differt apice subretuso non undulato et in area centrali verruca granulis circumdata. A ventre visum oblongum medio utrimque verruca seu papilla truncato-emarginata. Long. 20, lat. 16, crass. 11, isthm. 4 μ . [N:o 1037].

This variety is in its general appearance very like the var. *richmondiae* Playf., but is easily distinguished by the central papilla surrounded by granules. Compare also var. *casinoënsis* Playf., ibid. pl. 3 f. 13 and *C. subprotumidum* Nordst., West Mngr. III pl. 86 f. 19—25.

Hab. — (SW?), leg. Elfv. — Pl. 6 fig. 16—17.

C. sexnotatum Gutw.; West, Mngr. III pl. 86 f. 7. var. *denotatum*, nova var. Semicellulae lateribus 4-undulatis, apice recto non undulato; membrana intra margines radiatim granulata (sub ipso margine saepe granulis geminatis) et in medio supra isthmum granulis 9 parvis et depressis in series 3 longitudinales et 3 transversales ornata. A vertice visum oblongum medio utrimque leviter lateque tumidum (granulis non conspicuis). Long. 28, lat. 22, crass. 14, isthm. 8 μ . [N:o 1175].

The outline of the cells very much resembles var. *tristriatum* (Lütke.) West, Mngr. III pl. 86 f. 8—9, but the three cristae at the centre of the semicells, which are characteristic of this species, are in our variety each represented by 3 granules. Hereby it approaches *C. subcrenatum* Hantzsch. (West, Mngr. III pl. 86 f. 10—14).

Hab. In a basin in the Botan. Garden, Helsingfors (S). — Pl. 6 fig. 24—25.

C. abscissum nova sp. Cellulae mediocres, medio sinu anguste lineari extrorsum extremo subito ampliato profunde

constrictae. Semicellulae subsemicirculares-subtrapeziformes angulis basalibus valde rotundatis, lateribus convexis convergentibus, angulis superioribus non rotundatis, apice late truncato, marginibus omnibus levissime crispulis. Membrana granulis parvis sparsim obsessa, sed circa aream centralem plane glabra; utrimque supra isthmum granula nonnulla (2—5), itemque in area centrali (circ. 5) conspiciuntur. A vertice visum oblongum medio utrimque non vel vix sub-tumidum, summa apice glabro. Massa chlorophyllacea axilis in utraque semicellula nucleis amylaceis binis et laminis 8 radiatim exeuntibus. Long. 44—46, lat. 38—40, crass. 25, isthm. 12—14 μ . [N:o 1174].

Nearest to *C. botrytis* Menegh., from which it is distinguished by the broadly truncate apex, more depressed semicells, more rounded lower angles and more convex sides, as well as the delicate and sparse granulation.

Hab. In a basin, Botan. Garden, Helsingfors (S). — Pl. 6 fig. 18—19.

var. **subetchachanense** nova var. Marginibus plus crispis (apice glabro), membrana granulis densius obsessa, area glabra circumcentrali nulla; cellulis a vertice visis plus regulariter ellipticis. Massa chlorophyllacea ut in typo. Long. 48, lat. 39, crass. 25, isthm. 11 μ . [N:o 991].

This variety should be compared with *C. etchachanense* Roy & Biss. (West, Mngr. III pl. 81 f. 1) and with *C. botrytis*. Formerly I would have united both the type and the variety merely as varieties of *C. botrytis* (Compare f. ex. var. *depressum* West, Mngr. IV pl. 97 f. 6). But the outline of the cells and the nature of the granulation are very different. — Here I would remark that, in my opinion, var. *mediolaeve* West, Mngr. IV pl. 97 f. 5 and var. *mesoleium* Nordst., Desm. Ital. pl. 12 f. 2 are not forms of *C. botrytis* and should be relegated elsewhere. They belong to that group of *Cosmaria* which has the granules arranged concentrically and radially.

Hab. Near Helsingfors (S), leg. Elfv. — Pl. 6 fig. 20—21, 30.

C. cymatopleurum Ndt. var. **tyrolicum** Ndt., West, Mngr. III pl. 65 f. 11—12. Forma cellulis maioribus profundius constrictis, apice non retuso; a vertice visum crassius subangulosum. Long. 118, lat. 85, crass. 53, isthm. 28 μ . [N:o 1156].

Hab. Ekenäs, Jusarö (S). — Pl. 6 fig. 28—29.

C. perincisum, nov. nom. (Synon. = *C. margaritiferum* Menegh. var. *incisum* Kirchn., Alg. Schles. p. 150 et in litt. apud Nordstedt c. icon.; Borge, Torne Träsk p. 13; *C. margaritif.* forma Borge, Chl. Archang. p. 20 pl. 2 f. 15 sec. auct. ips. l. supra, page 13). Cellulae magnae medio incisura late aperto extrorsum paulum dilatata profunde constrictae. Semicellulae subellipticae basi fere recta apice late convexo; a vertice visae extense ovaes lateribus medio subrectis vix convexis. Membrana granulis rotundatis depressis in ordines transversales, obliquos, concentricos dense obsessa. Massa chlorophyllacea —? Long. 63, lat. 57, isthm. 19, crass. 32 μ . [N:o 831].

Our specimens were considerably larger than Borge's, thus agreeing with the measurements given by Boldt, but the granules are smaller and more densely arranged than stated by both these. In spite of these small differences I think they belong to one species which, as already suggested by Borge, is best regarded as a separate species. The only species that I find resembling *C. perincisum* are *C. holmii* Wille (Alg. Nov.-Zeml. og Kara-H. pl. 3 f. 2) and *C. pseudoholmii* Borge (Torne Träsk pl. 2 f. 1) but in the vertical view these are strongly tumid.

Hab. Gov. of Archangel. — Pl. 6 fig. 26—27.

C. magnificum Nordst., N.-Zeal. pl. 6 f. 19 page 62. Forma ad var. *suecicum* Borge accedens. Pars glabra membranae multo angustior; utrimque ad isthmum series simplex punctorum (=pororum); a vertice visum non tumidum. Massa chlorophyllacea parietalis, in utraque semicellula e laminis 4 parietalibus, quarum utraque nucleis amylaceis 2—5 (saepè 3) plus minusve in series subaxiles

ordinatis composita. Long. 103—120, lat. 80—99, crass. 53—57, isthm. 32—38 μ . [N:o 938].

It seems to me as if var. *suecicum* Borge (in Ark. f. Bot. vol. VI pl. 3 f. 31 page 40—41) and var. *italicum* Racib. (Nowe Desm. pl. 6 f. 1), as well as our form, differ only very slightly from the type. The median tumidity, the smooth area, and the arrangement of the granules and scrobicules are subject of a considerable individual variation. I do not think it possible always to distinguish between the above forms.

Hab. Messuby (W); Kimito (SW), leg. H. Warén. — Pl. 6 fig. 40—42.

C. malinvernianum (Rac.) Schmidle, Virnheim p. 58 (Syn. $\equiv$ *C. subtholiforme* Racib. Nowe Desm. pl. 5 f. 40). — Long. 61, lat. 53—54, crass. 32—35, isthm. 17 μ . [N:o 974].

In West's Monograph (vol. III p. 199) this species is regarded merely as a synonym of *C. margaritiferum* Menegh., although not with certainty. Also *C. malinvern.* var. *badense* Schmidle, l. c. pl. 7 f. 21 would, according to West, be identical with *C. margaritiferum* (l. c. page 201—202). On this point I cannot agree with these authors, as in my opinion *C. malinvernianum* is apparently quite a different species with characteristic features. It is to be desired that the original specimens of Schmidle or Raciborski were examined. *C. malinvernianum* is distinguished by 1:o) longer and more conical granules which become reduced at the centre of the semicells (whereas the central granules of *C. margarit.* are larger); 2:o) the scrobiculated central area is larger and the scrobiculations of a triangular shape; 3:o) in vertical view the apex is smooth (as by *C. margarit.*), but it is possible to see that in front view the marginal and submarginal granules are conspicuously arranged in 3 parallel series (this character is never present in *C. margarit.* but is quite evident in the figures of Raciborski and Schmidle); 4:o) the outline in front view is not identical because the lateral margins are less convergent and the apex broader, thus causing a difference in

the general appearance. — The scrobicules at the thickened and yellowish coloured central area are by high position of the microscope-tubus triangular but by lower position circular (the same structure being present in *C. cosmetum* West, Desm. U. S. pl. 17 f. 5 and *C. tholiforme* Cohn, Desm. Bong. pl. 11 f. 9). The chloroplasts are composed of 2 large pyrenoids in each semicell and numerous radiating plates (the details could not be seen). — Compare also *C. malinv.* var. *intermedium* Gutw., Nonn. alg. nov. pl. 7 f. 57.

Hab. Messuby (W). — Pl. 6 fig. 38—39.

C. ceratophorum Lütke m., Desm. Böhm. pl. 2 f. 6—9. Forma granulis marginalibus obtusis, nullis acutis; granulis plus regulariter ordinatis, in centro semicellularum semper 2 maioribus. Massa chlorophyllacea axilis in utraque semicellula nucleis amylaceis binis uterque laminis 4 radiatim exeuntibus. Long. 31—32, lat. 23—25, crass. 17—19, isthm. 6,6—7 μ . [N:o 1290, 1043].

Nearly related species are: *C. pilgeri* Schmidle, Alg. Volkens. pl. 4 f. 13; *C. reinschii* Arch. [syn. $\equiv$ *C. sp.* Reinsch, Contrib. pl. 18 f. 4]; *C. limnophilum* Schmidle, Beitr. alp. Alg. pl. 15 f. 20.

Hab. Near Imatra (SE), leg. Hj. Hjelt. — Pl. 6 fig. 31—34.

C. miraculum, nova sp. Cellulae mediocres medio incisura anguste lineari extremo quidem vix dilatata profunde constrictae. Semicellulae a fronte visae subrectangulares basi recta, apice fere recto, lateribus convexis ad apicem versus plus convergentibus, angulis superioribus rotundatis. Granula omnia obtusa, in ipsis marginibus lateralibus 6 (5—7) et intra margines 4 maiora, margo apicalis glaber sed sub apice granula 4 maiora et inferius granula parva 6 in arcum disposita; in centro semicellularum granula parva 8 regulariter disposita; circa granulum centrale scrobiculae 4 triangulae; supra isthmum granula singula magna conspiciuntur. A vertice visum extense oblongum, medio non tumidum. Massa chlorophyllacea e

nucleis binis axilibus et foliolis parvis in omnes ordines ex-euntibus composita. Long. 48, lat. 40, crass. 23, isthm. 13 μ . [N:o 975].

This species should be compared with *C. trachypleurum* v. *stellatum* Racib., Nowe Desm. pl. 5 f. 24, which differs with its granulation. Compare also *C. nodosum* f. *stellata* Eichl. & Racib., Now. Gat. ziel. pl. 3 f. 1.

Hab. Messuby (W). — Pl. 6 fig. 35—37.

C. turpinii Bréb. var. *eximium* West, Mngr. III pl. 83 f. 3; Borge, Torne-Träsk pl. 1 f. 19 („f. minor“). Long. 55—59, lat. 46—50, crass. 27, isthm. 9—11 μ . [N:o 1232].

This variety is possibly very closely related to *Euastrum occidentale* West (Mngr. II p. 67—68 pl. 39 f. 20). The Finnish form is very like the Swedish. Borge has suggested the relationship between *E. occidentale* and *C. turpinii* (Regnell, Exp. page 99) Again, the typical *C. turpinii* differs considerably, whereas this variety much more resembles *E. occidentale* than *C. turpinii*: the single central tumour, the finer granulation, the side view are not those of *C. turpinii*. (Our figure of the vertical view differs a little from West's figure). Finally, it should be noticed that the chloroplasts are similar to those of *E. verrucosum* (Cfr. Carter, Stud. Chloropl. I page 245).

Hab. Esbo (S), leg. C. Cz. — Pl. 7 fig. 64—66.

C. rectangulare Grun. var. *eichlerianum*, nov. nom. (Syn. $\equiv$ *C. rectangulare* apud Eichler, Mat. Flor. Miedz. pl. 1 f. 8). Differt a forma typica angulis inferioribus plus rotundatis, lateribus plus convergentibus, angulis superioribus granulis singulis parvis instructis, apice rectissimo; a vertice visum cellulis ellipticis. Long. 36, lat. 27, crass. 17, isthm. 10 μ . [N:o 935].

Would perhaps better be regarded as a separate species. Compare also *C. retusiforae* f. *ornata* Eichl. l. c. pl. 3 f. 29.

Hab. Keuru (C). — Pl. 7 fig. 1—3.

C. tetrachondrum Lund., Desm. Suec. pl. 3 f. 2.

Forma granulis intra margines laterales 4 utrimque ornata. Long. 28, lat. 25, isthm. 8μ . [N:o 905].

Very much resembles the form of Eichler (Flor. Miedz. pl. 3 f. 14), but differs from this by the entirely smooth (not undulate) margins.

Hab. Keuru (C). — Pl. 7 fig. 4—6.

C. sphagnicolum West, Mngr. III pl. 71 f. 11—14 var. **incisum**, nova var. Cellulae minores; a fronte visae medio incisura introrsum acuta lineari, extrorsum extremo dilatata profunde constrictae. Anguli infimi rotundati, supremi obtusi, laterales granulis singulis instructi; praeterea membrana sub angulos supremos granulis singulis ornata, ceterum glabra. A vertice visum extense sexangulare medio non tumidum. Long. $7,9$, lat. $7,9$, isthm. $2,6$, crass. $3,5\mu$. [N:o 1024].

Hab. Hirvensalo (SW), leg. Elfv. Pl. 7 fig. 27—27'.

C. polygonum (Näg.) Arch. var. **hexagonum** nova var. Cellulae dimidio fere minores medio sinu anguste lineari extrorsum dilatato profunde constrictae. Semicellulae sexangulares lateribus non retusis, in centro prominentia magna obtusata; membrana in angulis apicalibus et lateralibus intra margines granulis singulis minutissimis ornata. A vertice visum ut forma typica. Long. $9,2$ — $9,9$, lat. $9,2$, isthm. $2,5$, crass. $6,6\mu$. [N:o 1121].

Compare also *C. bireme* Nordst.; West, Mngr. III pl. 71 f. 36—37 which in other respects better agrees with our variety, but possesses a different central papilla.

Hab. Gov. of Archangel. — Pl. 7 fig. 24—26.

C. pseudoretusiforme, nova sp. Cellulae minutissimae medio sinu anguste aperto acuto profunde constrictae. Semicellulae trapeziformes angulis basalibus rotundatis, apicalibus subrotundatis; lateribus retusis parte basali prominenti; apice rectissimo. A vertice visum subrectangulare polis rotundatis; lateribus medio utrimque subtumidis. Membrana plane glabra (aut intra angulos granulis minimis difficillime quidem conspicuis ornata?). Long. $7,3$ — $7,9$, lat. 8 — $7,2$, isthm. 2μ . [N:o 1025].

Compare *C. subretusiforme* West, Mngr. II pl. 62 f. 19 which differs with a much broader isthmus and quite a

different vertical view. Compare also *C. geometricum* West, Mngr. III pl. 71 f. 5—6 and var. *adoxoides* West, Perry Stud. pl. 2 f. 47. Is perhaps nearest to *C. abbreviatum* Rac. f. *germanica* Rac., Nowe Desm. pl. 5 f. 32, which differs with twice the size and a regular depressed-elliptical vertical view.

Hab. — (SW?), leg. Elfv. — Pl. 7 fig. 21—23.

C. abbreviatum Racib. forma *germanica* Racib., Nowe Desm. pl. 5 f. 32. Forma cellularum varians, sed apex semper plus minus protusus. Sinus modo apertus, modo clausus. Cellulae a vertice visae anguste oblongae. Long. 13,₂, lat. 14,₅, isthm. 5,₃ μ . [N:o 1125 a, 1125 b].

Compare also *C. murrayi* Playf., Sydn. Desm. pl. 5 f. 19; West, Alg. Yan-Yean pl. 4 f. 5. — *C. pseudoretusi-forme* nob. (supra).

Hab. Gov. of Archangel. — Pl. 7 fig. 7 and 8—9.

C. pygmaeum Arch. var. *atimidum* nova var. Semicellulae a fronte visae depresso oblongae non angulosae, apice levissime et late convexo, angulis basalibus valde rotundatis; membrana sub apice utrimque ad latera versus granulis singulis parvis et in centro semicellularum granulis singulis ornata. A vertice visae anguste oblongae lateribus medio non tumidis sed utrimque granulis 3 ornatae. Long. 8,₆, lat. 9,₉, crass. 5,₃, isthm. 3,₉ μ . [N:o 1123].

On account of this species including various forms with very different outline I have thought it possible to unite our variety with this. In fact it is very near to the form figured in West, Mngr. III pl. 71 fig. 23.

Hab. Esbo (S), leg. C. Cz. — Pl. 7 fig. 19—20.

C. novae-semlicae Wille var. *sibericum* Boldt; West, Mngr. III pl. 68 f. 18. Forma papilla centrali abrupte truncata et granulis omnibus truncatis elongatis quasi papilliformibus. Long. 14, lat. 13, crass. 7, isthm. 6 μ . [N:o 1053].

Hab. Räikälä near the Imatra Falls (SE), leg. Hj. Hjelt. — Pl. 7 fig. 10—12.

C. venustum Bréb. var. *laticeps*, nova var. Cellulae maiores, subrectangulares; lateribus, ut in typo, triundulatis,

medio autem undula maxime prominenti; apice lato levissime retuso. In centro cemicellularum scrobiculae singulae. A vertice visum ellipticum. Long. 34—35, lat. 21—22, crass. 13, isthm. 7 μ . [N:o 861].

This variety is easily distinguished by its broad apex (only very little narrower than the base of the semicell) and the strongly prominent median undulation. Compare also various forms of *C. trilobulatum*.

Hab. Esbo (S), leg. C. Cz. — Pl. 7 fig. 13—14.

var. *excavatum* (Eichl. & Gutw.) West, forma duplo-maior. Forma cellularum eadem atque in typo. Long. 41,4, lat. 27,6, crass. 16,5, isthm. 4,6 μ . [N:o 833]. — Compare also *C. venustum* Bréb.; West, Mngr. III pl. 66 f. 2.

Hab. Gov. of Archangel. — Pl. 7 fig. 17—18.

C. tinctum Ralfs. var. *tumidum* Borge, Regnell, exp. pl. 3 f. 25. Forma sinu introrsum acuto, cellulis a vertice visis minus tumidis; membrana saepe luteola. Long. 11,1, lat. 10,6, isthm. 6,6 μ . [N:o 1035].

Hab. — (SW?), leg. Elfv. — Pl. 7 fig. 15—16.

C. bacillare Lütke m., Desm. Böhm. pag. 484. (Synon. $\equiv$ *Penium inconspicuum* West, New Brit. Frw. alg. p. 4 pl. 1 f. 6—7 and Mngr. I pl. 10 f. 15—17). Long. 19, lat. = crass. 7,2, isthm. 6,6, apex circ. 4 μ . [N:o 1028]. — Somewhat broader than the English form. Chloroplasts with one pyrenoid in each semicell.

Hab. Räikälä near Imatra Falls (SE), leg. Hj. Hjelt. — Pl. 7 fig. 38.

C. perminutum West, Frw. alg. Columbia page 1041. (Synon. $\equiv$ *Cylindrocystis minutissima* Turn.; West, Mngr. I pl. 5 f. 9; synonym. $\equiv$ *Cosmarium pseudarctoides* Ström, Frw. alg. Telemark page 31 pl. 3 f. 7—8). — Long. 10,6—11,9—12,6 lat. = crass. 6,6, isthm. 5,3 μ . [N:o 1178].

In his paper (l. c.) 1920 Ström created a new name for this species, which cannot be accepted because West (l. c.) already in 1914 transferred it to *Cosmarium* giving it a new name. — The cell-wall is thin with a few scattered pores (fuchsin + potass. acet.!) The chloroplasts are very

delicate and difficult to discern: there is one central pyrenoid in each semicell and four to six radiating plates.

Hab. A basin in the Botan. Garden Helsingfors (S). — Pl. 7 fig. 39—41.

C. subtile (West) Lütke m., Desm. Böhm. p. 494. var. **subsparsopunctatum**, nova var. Cellulae ad apices versus non aut vix attenuatae, apicibus semper rotundatis, lateribus medio levissime late subconstrictis. Membrana sparse ordinibus transversalibus 2—3 pororum ornata, ad isthmum quidem glabra. Massa chlorophyllacea in utraque semicellula nucleis amylaceis singulis (interdum unus tantum in ipso isthmo situs) lamellis que radiatim exeuntibus (saepe 6) composita. Long. 14,5—15,8, lat. max. 10,5 μ . [N:o 1184].

Compare also *C. subtile* f. West, Frw. alg. Columbia p. 1041 pl. 22 f. 51; and *Dysphinctium sparsepunctatum* Schmidle, Alpin. Alg. p. 348 pl. 15 f. 1—7. Some forms of the latter are in front view nearly identical with our variety, but, according to the author, the vertical view is elliptical.

Hab. Björkö in Esbo (S). — Pl. 7 fig. 34—37.

C. gostyniense (Racib.) nob. (Synon. $\equiv$ *C. abruptum* Lund. var. *gostyniense* Rac., Desm. Polon. pl. 11 f. 13). Cellulae parvae medio incisura anguste lineari profunde constrictae. Semicellulae subtrapeziformes angulis basalibus subrectis, lateribus divergentibus levissime retusis, apice levissime retuso, angulis superioribus oblique truncatis et retusis. A vertice visum oblongum medio utrimque prominentia papilliformi instructum. Membrana subtiliter porosa. Long. 17, lat. 14,5, crass. 9, isthm. 4,6 μ . [N:o 1020].

The Finnish form agrees quite well with Raciborski's description but possesses a somewhat broader apex, more abruptly truncate upper angles and a colourless cell-wall.

Hab. Near Åbo (SW), leg. Elfv. — Pl. 7 fig. 32—33.

C. angulosum Bréb. var. **scrobiculatum**, nova var. Semicellulae apice angustiore, angulis superioribus valde et abrupte truncatis, lateribus brevioribus, angulis basalibus non rotundatis subrectis; membrana in centro semicellu-

larum scrobicula parva ornata. A vertice visum ellipticum medio utrimque scrobiculis singulis. Long. 16,₅, lat. 12,₆, crass. 7,₉, isthm. 3,₉ μ . [N:o 1019 a].

Compare also *C. granatum* Bréb; West, Mngr. II pl. 63 f. 1—4; and var. *ocellatum* West, N.-Amer. pl. 15 f. 19; *C. pseudogranatum* Nordst., Symb. Brasil. f. 27; *C. angulosum* var. *concinnum* (Rabh.) West, l. c. pl. 72 f. 37—38.

Hab. — (SW?), leg. Elfv. — Pl. 7 fig. 30—31.

var. **tumescens**, nova var. Semicellulae a fronte visae angulis superioribus minus truncatis, quasi late rotundatis; a vertice visae ellipticae utrimque medio intumescencia parva. Long. 17, lat. 12, crass. 8, isthm. 4 μ . [N:o 1019 b].

Hab. Räikälä near Imatra Falls (SE), leg. Hj. Hjelt. — Pl. 7 fig. 28—29.

C. quadratulum (Gay) De Toni; Gay, Monogr. loc. Conj. pl. 1 f. 15; West, Mngr. III pl. 72 f. 33—34. In the description by West it is stated (page 121): „sinus narrowly linear with a slightly dilated apex“. This is not quite in keeping with the excellent figure given by Gay in which the sinus is open as in the Finnish form. (Also the above mentioned figure by West possesses an open sinus, but not pl. 93 f. 4). Compare also Printz, Beitr. Norweg. pl. 3 f. 58—59. Long. 14,₅, lat. 10,₆, isthm. 3,₂ μ . [N:o 1022].

Hab. Imatra, Räikälä (SE), leg. Hj. Hjelt.

var. **sublobatiforme**, nova var. Cellulae medio incisura anguste lineari profunde constrictae. Semicellulae plus rectangulares angulis non vel vix oblique truncatis, rotundatis. A vertice visum ellipticum medio utrimque eminentia parvula. Long. 15,₈, lat. 11,₉, crass. 7,₂, isthm. 3,₉ μ . [N:o 1021].

The general appearance in front view has a strong resemblance to *Euastrum sublobatum* Bréb. (West, Mngr. II pl. 40 f. 19), but the vertical view is quite different.

Hab. Räikälä near Imatra (SE), leg. Hj. Hjelt. — Pl. 7 fig. 53—54.

C. meneghinii Bréb. A figure will here be published which shows the arrangement of the pores (fuchsin + po-

tass. acet.). Long. 15,8, lat. 13,2, crass. 7,9, isthm. 6 μ . [N:o 1176].

Hab. In a basin, Botan. Garden, Helsingfors (S). — Pl. 7 fig. 51—52.

C. regnellii Wille; West, Mngr. III pl. 72 f. 25. Forma typica, long. 13,2, lat. 11,9, crass. 6, isthm. 4 μ . [N:o 947].

Hab. Messuby (W). — Pl. 7 fig. 49—50.

var. *minimum* Eichl. & Gutw., De nonn. spec. p. 164 pl. 4 f. 6. The Finnish specimens agreed quite well with the description and figure mentioned, but the size is somewhat larger and the apex more retuse. Our figures show the pores (fuchsin + potass. acet.) and the chloroplasts. Long. 14,5—15,8, lat. 13,2, crass. 8—8,6, isthm. 4—4,6 μ . [N:o 1180, 1179].

Very nearly related is *C. regnellii* as figured by Hirn, Desm. Finnl. p. 12 pl. 1 f. 14 which most probably is identical to Turner's form, E.-Ind. pl. 7 f. 25. Both these differ by the papilla-like prominence at the centre of the semicells.

Hab. A basin in the Botan. Gard., Helsingfors (S). — Pl. 7 fig. 55—56, 57.

C. pseudooctangulare, nova spec. Cellulae subparvae medio sinu anguste lineari profunde constrictae. Semicellulae subtrapeziformes leviter undulatae, quasi 8-angulatae (incl. basi), lateribus divergentibus, dorso late convexo, ipso apice subretuso. A vertice visum rhombiforme angulis rotundatis. Membrana glabra. Massa chlorophyllacea —? Long. 24, lat. 20, crass. 11, isthm. 6,6 μ . [N:o 948].

Perhaps nearest to *C. laeve* var. *octangulare* (Wille) West, Mngr. III pl. 73 f. 20. Compare also *C. impressum* var. *punctatum* Ström, Frw. alg. Caucasus pl. 2 f. 11.

Hab. Messuby (W). — Pl. 7 fig. 47—48.

C. miedzyrzecense Eichl. & Gutw., Nonn. spec. nov. pl. 4 f. 9. var. *monomazum*, nova var. Semicellulae plus distincte trilobulatae subtrapeziformes, apice elongato medio leviter retuso, lateribus e basi primum divergentibus tum

sinuato-convergentibus, angulis omnibus rotundatis, basalibus spinulam minimam gerentibus. Membrana supra centrum ocello (= eminentia parvula scrobiculā perforata) ornata, supra isthmum autem glabra. Long. 21, lat. 14, crass. 9, isthm. 4 μ . [N:o 1018]. — Compare also *C. trilobulatum* and its varieties.

Hab. — (SW?), leg. Elfv. — Pl. 7 fig. 45—46.

C. angulare Johns., New rare desm. I pl. 211 f. 14, var. **bicostatum**, nova var. Semicellulae, ut in typo subtrapeziformes, margines autem angulis pluribus et plus obtusatis, anguli basales submucronulati. Membrana medio costis seu iugis depressis binis longitudinalibus ornata. A latere visae semicellulae subcirculares; a vertice visae latius ellipticae medio utrimque papillis parvis (= costae a fronte!) binis conspicuis. Long. 30, lat. 27, crass. 19, isthm. 8 μ . [N:o 1031].

The size and general appearance agree well with the type, but the angles are less edged and there are three lateral sides. The vertical view is considerably broader than Johnson's figure, but this is probably somewhat exaggerated if one may judge from the breadth in front view and the thickness in side view! — Compare also *C. sulcatum* Nordst. f. West, Madagasc. pl. 9 f. 29 and *C. rectangulare* var. *australe* Playfair, Polymorph. pl. 13 f. 15—16, which both possess an open sinus and a different outline.

Hab. Near Åbo (SW), leg. Elfv. — Pl. 7 fig. 42—44.

C. obsoletum (Hantzsch) Reinsch; West, Mngr. II p. 133—134 pl. 56 f. 1—3. — Long. 42, lat. 51, crass. 26, isthm. 21 μ . [N:o 1051].

The size and the outline are in agreement with the description by West, whilst the cell-wall is coarsely porose-scrobiculate as in the large tropical forms. Also the cone-shaped „pore“ or „spine“ at the basal angles was always present, and the cell-wall is always double, the outer one being quite hyaline. (Cfr. Gutwinski, Alg. Java pl. 38 f. 39—40). Our figure, which is made from a cell prepared

with fuchsin and potassium acetate, shows that the basal „pore“ has been of a very dark colour like the pores, whereas the inner cell-wall is lighter and the outer nearly colourless. Again, no opening of these basal „pores“ could be seen, the nature of them therefore being very doubtful. — It is particularly noticeable that the original specimens distributed and described by Hantzsch in Rabenhorst's Exsicc. n:o 1407 (sub nom. *Arthrodesmus obsoletus* Hantzsch) are furnished with a small but unmistakable spine at each basal angle! Furthermore, these spines were not enclosed in an outer hyaline cell-wall, which could not at all be detected. (The specimens were studied dried but also in cold water). Again, in fresh material an outer cell-wall has been found according to the description by Hantzsch (l. c.): „Die ganze Zelle ist mit einer zarten wasserhellen Hülle umgeben, die nur am Einschnitt und um die Stacheln etwas abhebt und daher sichtbar wird.“ — — „überwiegende Mehrzahl der Exemplare — — des Stachels entbehrt —“. On the whole, this is a matter which ought to be inquired into. Both stained material and living individuals should be examined. Perhaps there really are two species that have been confused. In any case I do not think the description and the remarks of Messrs West (l. c.) quite correct. They only speak of a „mamillate thickening“ at the basal angles „which can be quite hyaline with the exception of the conical pore, which then stands out very prominently, and has the appearance of a short spine — —“. But there is not a word about the outer cell-wall! — I have never seen living individuals, so I am unable to give my opinion in this question.

Hab. Räikälä near Imatra (SE), leg. Hj. Hjelt. — Pl. 7 fig. 58—60.

C. pseudotinecense, nova spec. Cellulae magnae medio incisura lata leviter constrictae. Semicellulae subpyramidatae ad apicem versus attenuatae, lateribus sub apice levissime retusis, apice late rotundato; a vertice visae circulares. Membrana sparse porosa utrimque ad isthmum seriebus

singulis pororum ornata. Massa chlorophyllacea axilis laminis radiatim e centro exeuntibus circiter 12 et nucleis amylaceis permagnis oblongis in utraque semicellula singulis. Long. 144, lat. 53—56, apex 23—24, isthm. 49—51 μ . [N:o 906].

This beautiful large *Cosmarium* very much resembles *C. turgidum* var. *tinecense* Racib., Nonn. Desm. Polon. pl. 10 f. 2 but is easily distinguished from that species by the chloroplasts. (In his description Raciborski did not at all mention the chloroplasts, and consequently it must be presumed that they are parietal as in the typical *C. turgidum*). Compare also *C. elongatum* Racib., ibid. pl. 1 f. 1 and *Dysphinctium grande* Delp. var. *cuneatum* Turner. E.-Ind. pl. 7 f. 5.

Hab. Lempäälä (W). — Pl. 7 fig. 61.

C. cucurbitinum (Biss.) Lütke.; West, Mngr. I pl. 9 f. 13—14 (sub nom. $\equiv$ *Penium cucurb.*) var. **grande**, nova var. Cellulae multo maiores lateribus subconvexis vel convexis, apicibus valde rotundatis. Membrana subtiliter porosa. Long. 118, lat. 46, isthm. 42 μ . [N:o 840].

This rather large variety is more rounded at the apices than the typical form and more broadly rounded than var. *scoticum* West.

Hab. Gov. of Archangel. — Pl. 7 fig. 62.

C. cucurbita Bréb.; West, Mngr. III page 106—107. I have here the opportunity to publish a figure of the mature zygospore. The drawing was made by Professor F. Elfving many years ago, but has not been published before now. No measurements were given. — Pl. 7 fig. 63.

C. enontekiense, nova spec. Cellulae minutissimae medio incisura late aperta modice constrictae. Semicellulae cuneatae, apice recto, angulis rotundatis, lateribus subrectis vel subconvexis. A vertice visum rectangulare lateribus longioribus rectissimis, lateribus brevioribus retuso-emarginatis. Membrana glabra. Long. 6, lat. 7,3, crass. 3,5, isthm. 4,5 μ . [N:o 1235].

The characteristic vertical view at once distinguishes this species from all known *Cosmaria*.

Hab. Enontekis Lappmark (NW), leg. M. Kotilainen. — Pl. 7 fig. 67—68.

Genus *Xanthidium* Ehr.

X. antilopaeum (Bréb.) Kütz. This species is the one of the polymorph Desmids that includes the greatest number of various forms. These have been arranged into several groups called varieties, but have often been confused with each other or even with some other species. Therefore I have brought together the following review including all forms recorded from Finland and a supplementary list of all other forms.

a) The typical form: *X. fasciculat.* var. *polygonum* Ehr., Infus. (1838) pl. 10 f. 24 a. — *Heterocarpella antilopaea* Bréb. in Cheval. Des. Micr. (1839) p. 272 [non ipse vidi!]. — *X. fasciculatum* a Ralfs in Ann. Mag. Nat. Hist. XIV (1845) pl. 12 f. 3 a—d; Ralfs Brit. Desm. (1848) pl. 20 f. 1 b [non a etc!]; Delponte, Desm. subalp. (1877) pl. 13 f. 20—23 [non f. 24—26! = *X. hastiferum*]; Turner, Alg. Strensall (1883) f. 12; Wolle, Desm. U. S. (1884) pl. 22 f. 4—5; Hauptfleisch, Zellmembr. (1888) pl. 2 f. 73; (?) F. B. Carter, Desmids (1889) fig. 14; (?) Saunders, Flora Nebraska (1894) pl. 6 f. 13—14; *X. polygonum* Hassall, Brit. Frw. alg. (1845) pl. 89 f. 4. — *X. antilopaeum* (Bréb.) Kützing, Spec. alg. (1849) p. 177; Cooke, in Quekett M. J. VI (1881) pl. 13 f. B; Wittrock et Nordst. exsicc. n:o 577 (1883); Wolle, Desm. U. S. (1884) pl. 23 f. 1—2; Cooke, Brit. Desm. (1887) pl. 46 f. 2; West, New interest. frw. alg. (1898) pl. 4 f. 42; Comère, Desm. France (1901) pl. 15 f. 14; Saunders, Transact. Wash. Acad. III (1901) pl. 43 f. 38; Hirn, Desm. Finl. (1903) pl. 2 f. 33; West, Brit. Frw. alg. (1904) page 169 f. xyl. 63 B.; West, Monogr. IV (1912) pl. 108 f. 7—9, 18. — *X. fasciculatum* var. *hexagona* Wolle, Desm. U. S. (1884) pl. 23 f. 5—6. — *X. antilopaeum* var. *hirsutum* Gay, Monogr. loc. (1884) p. 77. — *X. spinulosum* Bennett, Frw. alg. Engl. lake-distr. (1886) pl. 2 f. 17; Cooke, Brit. Desm. (1886) pl. 46 f. 4. — [? *X. fasciculatum* v. *ornatum* Schmidle, Beitr. Schwartzw. (1893) pl. 4. f. 6]. — *X. antilopaeum* var. *fasciculoides* Lütke m., Desm. Attersees (1893) [= *X. fasciculatum* Ralfs 1848 fig. 1 b; = *X. antilop.* in Witt. & Ndt. exs. n:o 574]. — [? *X. antilop.* var. *schmidlei* Borge, in Nuov. Notar. VI (1895) page 25. (= *X. fascicul.* v.

ornat. Schmidle l. c.; non *X. antilop.* v. *ornat.* Anderss. l. c.)] — *Holacanthum antilopaeum* (Bréb.) Migula, Krypt. Flor. (1906) pl. 26 D f. 3; Migula, Die Desmid. (1911) pl. 6 f. 15. — *Holacanth. antil.* var. *fasciculoides* Lütke.; Migula, Krypt. Flor. (1906) page 516; Dick, Desm. Südbayer. (1919) pl. 16. f. 3. — *Holacanth. fasciculatum* (Ehr.) Francé; Migula, Krypt. Flor. (1906) pl. 27 D f. 5; Migula, Die Desmid. (1911) pl. 6 f. 13.

Nearest to the typical form must be placed as „formae“ the following, which have not been recorded from Finland:

X. antilop. f. *depressa* Turner, E.-Ind. (1893) pl. 12 f. 24; Petkoff, Per. Spisan LVIII (1899) pl. 1 f. 25; — f. *Borge*, Regnell exp. (1903) pl. 4. f. 4; — f. *Borge*, ibid. pl. 4 f. 5.

Hab. In all parts of Finland; Gov. of Arch. — Pl. 4 fig. 1—7.

b) var. **triquetrum** Lundell, Desm. Suec. (1871) pl. 5 f. 1; Wölle, Desm. U. S. (1884) pl. 22 f. 1—3; Eichler; Flor. Miedzyrzec. (1893) pl. 10 f. 35; West, Monogr. IV (1912) pl. 109 f. 1; — var. *fasciculoides* f. *triquetrum* (Lund.) Lütke., Attersee (1893) page 547.

To this variety belong the following forms:

var. *triquetr.* f. *brasiliensis* Nordst., Alg. Brasil. (1877) p. 26 fig. xyl. 4. — var. *triquetr.* f. *minor* Racib. Now. Desm. (1889) p. 107. — (Not in Finland). — A form with an accessory third spine at the apical angles was seen. — On the contrary the form described by Eichl. and Gutwinski as *X. antil.* v. *triq.* f. *hexagona* does not belong here but perhaps to *X. fasciculatum*!

Hab. Widely distributed in lakes. — Pl. 4 fig. 8.

c) var. **polymazum** Nordst., Norg. Desm. (1873) pl. 1 f. 20; Wölle, Desm. U. S. (1884) pl. 23 f. 3—4; West, Mngr. IV (1912) pl. 108 f. 19 and pl. 109 f. 2. — *Holacanthum antilopaeum* v. *laeve* Schm., Torka, Mg. Flor. Bromberg (1912) pag. 150 fig. D.

To this variety belongs:

var. *polymaz.* f. *major* Turn. E.-Ind. (1893) pl. 13 f. 1 (Not in Finland).

The accessory third spine at the basal angles was sometimes as long as the other spines, sometimes smaller or even totally absent.

Hab. Widely distributed.

d) var. **dimazum** Nordst., Norg. Desm. (1873) pl. 1 f. 19. Borge, Sverig. chlor. II (1895) pl. 1 f. 6. — *X. antilop.* var. *ovale* Schmidle, Pite Lappm. (1898) pl. 3 f. 17.

This variety includes a number of various forms.

Hab. Keuru (C); Messuby near Tammerfors (W). — Pl. 4 fig. 9—14.

e) var **minneapoliense** W o l l e in Bull. Torr. B. Cl. XI (1884) page 16; W o l l e, Desm. U. S. (1884) pl. 52 f. 16; West, N.-Amer. (1896) page. 253 fig. xyl. 2. — var. *minneap.* f. J o h n s o n, New rare Desm. (1894) pl. 211 f. 1. — var. *johnsonii* West, N.-Amer. (1896) p. 253 [≡ v. minn. f. J o h n s. 1894].

The accessory subapical spines were always below (within) the semicircular series of granules. Basal angles with 2 or 3 spines as by var. *polymazum*, which is closely allied, only differing by the absence of the subapical spines; these spines are also sometimes absent in the one semicell of v. *minneapoliense*. It would perhaps be better to unite v. *minneapoliense* with v. *polymazum* as only a form of that variety.

Hab. Gov. Archangel. — Pl. 4 fig. 15—16.

f) var. **basiornatum** Eichl. & Racib., Now. gat. ziel. (1893) pl. 3 f. 31. — *Holacanth. antilop.* var. *fasciculoides*, forma, Dick, Südbayer. (1919) pl. 16 f. 2.

This variety shows a characteristic outline, the angles being elongated into short mamillate processes, each terminated by a straight spine. Isthmus often yellowish between the series of scrobiculations. The centre of the semicells not thickened but furnished with a papilla, which sometimes (rarely only) is grown out into a spine (as by var. *canadense* J o s h.!).

Hab. Keuru (C), Räisälä (SW). — Pl. 4 fig. 17—18.

g) var **laeve** S c h m i d l e, Beitr. Alg. Schwarzw. (1893) pl. 4 f. 7; West, Mngr. IV (1912) pl. 109 f. 3; Gistl, Bayer. Hochmoor. (1914) pl. 2 f. 3.

I have not seen the typical form of this variety, nor any other form with a smooth (not thickened or scrobiculate) central area. But we have in Finland a somewhat larger form with the semicells broadly 6-angulate, the sinus more open, cell-wall smooth but with a (smooth or at the apical part finely punctate) central thickening. This form, which is conspicuously larger than the other ones, would as I think best be placed as a „forma **incrassata** nov. f.“ of var. *laeve*. (Cum. spin. long. 103—110, lat. 103—110, sine

spin. long. 80—86, lat. 64—76, crass. 53, isthm. 25 μ). [N:o 738 b, c.].

To this variety belong probably also:

X. antil. v. laeve f. irregularis West, New. Brit. Alg. (1894) pl. 2 f. 44; West, Monogr. IV (1912) pl. 109 f. 4. — var. *fasciculoides f. involuta* Lütke m., Attersee (1893) p. 548 [consult West, Mngr. IV page 68!]. — (?) *X. antilop.* Levander in Festschr. f. Palmén (1905) pl. 1 f. 9; (?) Lobik, Desm. Pskow (1913) pag. 82 fig. 10 (the right); (?) Kufferath, Flor. Alg. Luxembg. (1914) page 300 f. xyl. 10—11.

I have seen monstrous semicells of this variety with a little accessory spine at each apical angle. Such an abnormal cell is probably also *X. fasciculatum*, Hirn, Desm. Finnl. (1903) pl. 2 f. 35.

Hab. Keuru (C); near Tammerfors (W). — Pl. 4 fig. 19—20.

h) var. *oligacanthum* Schmidle, Chlor. Virnheim (1894) pl. 7 f. 10; West, Mngr. IV (1912) pl. 109 f. 5.

The typical form has a not differentiated central area (as var. *laeve*). But the Finnish forms always have a thickened (smooth or scrobiculate) central area.

Here belong the following forms:

var. *oligacanth. forma* West, Frw. alg. N.-Irel. (1902) p. 31; West, Mngr. IV (1912) pl. 109 f. 6.

Hab. Messuby (W). — Pl. 4 fig. 21—22.

i) var. *hebridarum* West, Furth. contr. Scott. Pl. (1905) pl. 7 f. 21; West, Mngr. IV (1912) pl. 109 f. 7 and pl. 110 f. 1—2; Ström, Phytoplankt Norweg. (1921) pl. 1 f. 16 page 30.

The apical spines single or two.

Hab. Keuru (C); „Isthmus karelicus“ (SE). — Pl. 4 fig. 23—24.

k) var. *crameri*, nov. nom.; *X. fasciculatum* Cramer in Hedwigia 1863 pl. 12 f. 2.

Anguli superiores spinis geminatis parallele suprapositis ornati, anguli basales spinis binis non suprapositis sed iuxta defixis divergentibusque (ut fiat angulus circ. 90° inter eas). Semicellulae plus depressae. Membrana in centro semicirculo vel $\frac{3}{4}$ -circulo scrobicularum ornata praetereaue in-crassata luteola. A vertice visum plus rhomboidiforme. Cum

spin. long. 76—81—80 lat. 84—86—91; sine spin. long. 59—57—57, lat. 58—57—56; crass. 38—35; isthm. 15—18—15; long. spinae 15—18—19 μ . [N:o 962 b].

This variety is easily distinguished by the apical spines, which are normally attached side by side, and the basal ones, which are separated some distance apart and divergent. The central area is thickened and yellowish in colour and furnished with a simple series of scrobiculations arranged in $\frac{3}{4}$ of arc.

Here belong probably also:

(?) *X. antilop.* f. Börgesen, Östgrönland (1894) pl. 1 f. 16. — (?) *X. antilop.* f. Börgesen, ibid. pl. 1 f. 17. — (?) *Holacanth. antilop. v. fasciculoides* f., Dick, Südbayer (1919) pl. 16 f. 4 [apparently identical with f. Börgesen, fig. 16.]

Hab. Keuru (C); Lempäälä (W). — Pl. 4 fig. 28—29.

1) var. **ornatum** Andersson Sverig. chlor. (1890) pl. 1 f. 6. — (?) *X. fasciculatum*, Ralfs, Brit. Desm. (1848) pl. 20 f. 1a et 1c (non 1b!); De Notaris, Elementi (1867) pl. 4 f. 36. — *X. antilop.* (?) Jelliffe, Prel. list. (1893) pl. 2 f. 17; Roy & Bisset, Scott. Desm. (1894) pl. 3 f. 13; (?) Moesz, Brass. mikr. növen (1902) pl. 4 f. 5. — (?) *X. antil. var. vallesiacum* Viret, Desm. Trient. (1909) fig. 12. — *X. antilop.* Lobik, Desm. Pskow (1913) f. 10 (left); Gistel, Bayer. Hochm. (1914) pl. 4 f. 1; (?) Carter, Chlor. stud. (1919) pl. 18 f. 106—107.

As the original diagnosis by Andersson (=Borge) is quite short and moreover in one respect inaccurate, I have attempted to give the complete description. The Finnish form agreed very well with the Swedish one, excepting the fact that the central protuberance was surrounded by a simple ring of scrobiculations, whilst Borge described his variety as furnished with a ring of granules. I wrote concerning this matter to Dr Borge, who very kindly informed me that he, after studying the original specimens (from Vaddö, Sweden) in all views, could ascertain that these also were furnished with a ring of scrobiculations, not with granules. — It seems to me on no account correct to unite this well marked variety with the typical form as a synonym, as is done by West (Mngr. IV page 64).

Semicellulae conspicue sexangulatae. Spinae omnes geminatae (numquam singulae), apicales valde sursum, basales valde deorsum inclinatae, longae tenues graciliter curvatae. Membrana in area centrali papilla (seu protuberantia) depressa, parva, glabra, circa eam circulo simplici scrobicularum ornata. Cum spin. long. 70—80—76, lat. 76—84—88, sine spin. long. 57—51— $\times$, lat. 51—48— $\times$, crass. 32, isthm. 15—19—21, long. spinae 15—19 μ . [N:o 734, 927].

This variety is easily recognized by the markedly 6-angulate semicells, the long, slender and gracefully curved, always paired spines, the apical ones being directed obliquely upwards forming an angle of 90° with the upper lateral sides, the basal ones downwards (continuing the direction of the upper lateral sides).*) The central area is not thickened but possesses a slight smooth papilla surrounded by a simple ring of scrobiculations.

Very nearly related to this variety seems to be *X. controversum* var. *planctonicum* West, Mngr. IV pl. 107 f. 7—8, which in my opinion would perhaps better be transferred to *X. antilopaeum*. — In a monstrous semicell of var. *ornatum* there was a short accessory spine just above the normal basal spines.

Hab. Keuru (C); near Tammerfors (W). — Pl. 4 fig. 30—31.

Fully agreeing with West (Mngr. IV page 66) I do not think it possible to separate var. *fasciculoides* Lütke m. (Desm. Attersees, 1893 page 547) as a distinct variety. Consequently it is here omitted.

The remaining forms of *X. antilopaeum*, which do not belong to the varieties mentioned above, have not been recorded from Finland. They may be enumerated here as follows:

X. antilop. forma Nordst., Alg. Brasil. (1877) p. 26 fig. xyl. 5. — forma Nordst., ibid. p. 27 fig. xyl. 6. [Would perhaps better be transferred to *X. hastiferum*]. — var. *canadense* Josh., New rare Desm.

*) The same arrangement of spines is sometimes met with in var. *polymazum* and var. *minneapolisense*!

III (1885) pl. 254 f. 5; West, N.-Amer. (1896) pl. 16 f. 2. — var. *tropicum* Lagerh., Alg. bidr. II (1887) p. 198 fig. xyl.; Borge, Trop. subtrop. (1899) pl. 1 f. 17. — forma Borge, ibid. pl. 1 f. 16. Nearest to the above variety as a form with paired basal spines. — f. *curvispinum* Cushm. in Rhodora VII (1905) pl. 64 f. 11. — f. *callosum* Cushm., ibid. pl. 64 f. 12. [In my opinion nearest to *X. controversum*; the outline resembles *X. cristatum*]. — var. *depauperatum* West, Orkn. Shetl. (1905) pl. 1 f. 15—16; West, Mngr. IV (1912) pl. 110 f. 3—7 [Synon. ≡ *X. antil.* forma West, Scott. frw. plankt. (1903) pl. 16 f. 1 — According to West.] Here belongs apparently also *X. antil.* forma West, Frw. alg. W-Irel. (1892) pl. 22 f. 2.

X. fasciculatum, Larsen, E.-Greenl. (1904) fig. xyl., is nothing more than a deformed form of *X. antilopaeum*. [Vide West, Mngr. IV page 66.]

The following forms which originally were described as forms of *X. antilopaeum* do not belong here:

f. *javanica* Nordst., Alg. Mus. Lugd. Bat. (1880) pl. 1 f. 21 is = *X. hastiferum* Turn. — var. *truncatum* Wolle, Desm. U. S. ed. II (1892) pl. 42 f. 3—5 is = *X. tylerianum* West. — f. *javanica* Johnson, Rare Desm. U. S. II (1895) pl. 239 f. 10 is = *X. hastiferum* var. *johnsonii* West. — forma West, N.-Amer. (1896) pl. 16 f. 1 is = *X. controversum* West. — var. *javanicum*, Wildem., Flor. Buitenzorg (1900) p. 138 fig. xyl. is = *X. hastiferum*, Turn. — var. *incertum* Schmidle, Alg. Nyassa (1903) pl. 2 f. 5, should be relegated elsewhere, according to West (Mngr. IV p. 66.)

Amongst these forms there are especially two viz. *X. hastiferum* and *X. controversum* that are very near to *X. antilopaeum*. Perhaps these would better be reunited with *X. antilopaeum*. (Vide also Nordstedt N.-Zeal. page. 43!) — Another species closely allied is our new species *X. pseudo-bengalicum* nob.

In the past *X. antilopaeum* and *X. fasciculatum* have been confused, but they are always easily distinguished.

***X. pseudobengalicum* nov. sp.** Cellulae mediocres, medio sinu profundo introrsum lineari, extrorsum valde dilatato constrictae. Semicellulae a fronte visae subellipticae-trapeziformes, non angulosae; in marginibus lateralibus utrimque spinae 3 longae graciliter sursum curvatae defixae sunt; area centralis incrassata et conspicue luteola — fere rubrobrunnea glabra, non porosa. A vertice visae rhomboidiformes utrimque

medio incrassatione prominenti, spinis asymmetricis utrimque prope planum medianum defixis. Membrana subtiliter porosa. Massa chlorophyllacea e laminis 4 in utraque semicellula, unusquisque singulis nucleis amylaceis, composita. Cum spin. long. 76—87—87, lat. 78—87—101; sine spin. long. 61— $\times$ —64,³ lat. 55— $\times$ —57, crass. 38, isthm. 15—15—19, long. spinae max. 11,⁵— $\times$ —19 μ . [N:o 790 b].

This new species I formerly regarded as only a variety of *X. antilopaeum*. But the differences were too apparent. It could not be united with any variety already described although it is nearest to var. *hebridarum* West, nor could it be made a new variety. It differs from var. *hebridarum* by the (in front view) elliptical, not sexangulate semicells, the curvate and constantly unpaired, asymmetrically arranged spines, the entirely smooth, slightly protuberant and strongly coloured central area and the, in vertical view, rhomboid-shaped cells. Our species should also be compared with var. *oligacanthum* Schmidle; *X. bengalicum* Turn., E.-Ind. pl. 12 f. 32 (and Cushman in *Rhodora* N:o 7, 1905 pl. 14 f. 10, which is not identical with Turner's species); *X. hastiferum* f. *inevolutum* Nordst., N-Zeal: pl. 4 f. 24; *X. hastiferum* v. *johnsonii* West (synon. $\equiv$ *X. antilop.* f. *javanicum* Johnson, Rare Desm. II pl. 239 f. 10; (— not Nordstedt 1880!) especially the one semicell with unpaired, asymmetrical spines at the apical angles.

Hab. Keuru (C); Gov. of Archangel. — Pl. 4 fig. 32—33.

X. tetracentrotum Wolle f. **protuberans** West, Mngr. IV pl. 107 f. 3. The Finnish form agrees quite well with the English one, but I think it is very doubtful, whether it is a form of *X. tetracentrotum*, or would better be placed elsewhere. Compare also *X. antilop.* v. *dimazum* Ndt; *X. pseudobengalicum* nob; *X. subhastiferum* v. *murrayi* West. — Cum spin. long. 49, lat. 84, sine. spin. long. 49, lat. 46, crass. 27, isthm. 11, long. spinae 19 μ . [N:o 901].

Hab. Lempäälä (W). — Pl. 4 fig. 34—35.

X. fasciculatum Ehr.; West, Mngr. IV pl. 111 f. 6—8 (Syn. $\equiv$ *X. fascic.* var. *ornatum* Nordst., Desm. Grönl.

pl. 7 f. 10). This species is also in Finland very much rarer than *X. antilop.* and *X. cristatum*.

var. **oronense** West, Desm. N.-Amer. pl. 15 f. 25. Forma semicellulis plus depressis, in centro circulo simplici granulorum ornata. Cum spin. long. 72, lat. 72, isthm. 19 μ . [N:o 902]. — The Finnish form is generally more depressed, the central granules are regularly arranged in a ring. At the basal angles 2—3 granules. Just below the basal spines is sometimes a small accessory one. — The form described and figured by Schmidle as „f. *lapponica*“ (Pite Lappm. 1898 pl. 1 f. 15) is nothing but a form of this variety: var. *oronense* f. *lapponica* (Schm.) nob.

Hab. Lempäälä (W). — Pl. 4 fig. 38.

var. **longispinum** nova var. Cellulae multo maiores. Semicellulae angulis basalibus valde rotundatis, lateribus vix angulatis, sed valde convexis, apice recto latioreque, ut quasi sexangulato-trapezo-subellipticae fiant; in utraque semicellula aculei 6 geminati vel haud raro in angulis superioribus aculei gemini inferiusque 3 vel 4 vel 5 plus minus irregulariter defixi; aculei omnes graciliter curvati, maxime autem apicales. Membrana subtiliter porosa, in area centrali vix protuberanti glabra incrassata luteola. A vertice visum crassius. Massa chlorophyllacea parietalis e laminis 4 parietalibus pyrenoidibusque totidem composita. Cum spin. long. 95—103, lat. 84—95, sine sp. long 66—70, lat. 57—61, isthm. 19—23, long spinae 13—19 μ . [N:o 989].

This remarkable variety is easily distinguished by its larger size and its much longer, always slightly curved spines. Basal angles more rounded, the form of the semicells resembling *X. antilopaeum*. The semicells usually possess six pairs of spines, but the spines are, however, frequently more or less irregularly arranged and vary in number from 10—14 in each semicell. The distance between the apical spines is greater and the basal ones are placed more upwards from the base of the semicells. Central area conspicuously thickened and of a yellowish colour but always quite smooth. — This variety very much resembles

X. antilopaeum, especially „forma“ Nordstedt, Alg. Brasil. (1877) page 26 fig. xyl. 5. Nevertheless our form with its, most commonly, six pairs of spines is apparently nearest to *X. fasciculatum* and is in my opinion best placed here. It is most probable that this variety with equal justice could be separated as a distinct species. A central spine (as in *X. antil. v. canadense*) was observed once.

Hab. Räisälä (SE). — Pl. 4 fig. 25—27.

X. cristatum Bréb. A form of var. *uncinatum* Bréb. with an accessory spine at each apical angle was observed. (Pl. 4 fig. 36). [N:o 824]. Likewise f. *polonica* Gutw. was observed with some small accessory spines above each basal angle. (Pl. 4 fig. 37). [N:o 1117].

var. **dimazum** Grönbl., Desm. Keur. Semicellulae 8-angulato-ellipticae in area centrali papillis binis glabris ornatae, ceterum membrana glabra subtiliter porosa. Cum spin. long. 61, lat. 57; sine spin. long 49, lat. 44, isthm. 15, crass 32 μ . [N:o 958]. — This variety is particularly noticeable as being analogous to the var. *dimazum* of *X. antilopaeum*.

Hab. Messukylä (W). — Pl. 3 fig. 47—48.

var. **uncinatum** Bréb. f. **longispina** nova f. Semicellulae truncato-pyramidatae angulis rotundatis, lateribus retusis convergentibus (ut in Ralfs, Br. D. pl. 19 f. 3 d, 3 e); sinu aperto introrsum rotundato. Membrana glabra, subtiliter porosa, in area centrali incrassata fusco-lutea. Cum. spin. long. 87, lat. 80, sine spin. long. 62, lat. 47, long. spinae ad 19, isthm. 13 μ . [N:o 803]. — The basal spines are sometimes very small or even totally absent. The central area is always smooth. Compare Borge, Süsw. Chlor. Archang. pl. 2 f. 14.

Hab. Gov. of Archangel. — Pl. 3 fig. 46.

Forma ad *X. mayori* West (Columb. 1914 pl. 22 f. 41) valde accedens. Spinis basalibus singulis, mediis ternis (vel geminatis), superioribus geminatis, praeterea infra apicem spinis singulis. Membrana in area centrali incrassata fusco-lutea protuberantiis binis parvis glabris. Cum. spin. long. 76, lat. 72, crass. 34, isthm. 15 μ . [N:o 607]. — Only one cell

was observed. Vide also *X. crist.* var. *spinuliferum* West, Mngr. IV pl. 110 f. 12.

Hab. Keuru (C). — Pl. 3 fig. 49—50.

X. concinnum Arch.; West, Mngr. IV pl. 112 f. 10. var. **varians**, nova var. Sinus plus minus apertus. Semicellulae subtrapeziformes-sexangulatae lateribus inferioribus longioribus, lateribus superioribus brevioribus; spinis non geminatis, superioribus longioribus, inferioribus brevioribus in angulis defixis, praeterea spinulis minutissimis nonnullis irregulariter dispositis; papilla centralis abrupte truncato-emarginata; a latere visae subcirculares; a vertice visae regulariter ellipticae. Long. 10,6, lat. 10,6—11,3, isthm. 2,6—3,9, crass. (c. papill.) 8 μ . [N:o 1275].

This variety is easily distinguished by the unpaired spines at the angles, the small accessory spines and the more subtrapeziform semicells.

Hab. Esbo, (S) leg. C. Cz. — Pl. 7 fig. 71—73.

Genus *Arthrodesmus* Ehr.

A. curvatus Turn., E.-Ind. pl. 11 f. 33 and pl. 12 f. 2, 7, 13; Bernard, Desm. Prot. Java 1908 pl. 7 f. 196—197; Bernard 1909 fig. 97; var. **imatrensis**, nova var. Spinis convergentibus incurvatis, sed non recurvatis, semicellulis plus depressis, isthmo angustiore introrsum acuto-subacuto, cellulis minoribus. Long. 30, cum spin. lat. 57, sine sp. lat. 38, isthm. 8—11 μ . [N:o 1069].

This variety is more closely allied to *A. curvatus* than to *A. convergens*: the open sinus, the very slightly and not at all convex apex, the triangulate-cuneate semicells, all these features are characteristic of *A. curvatus*.

Hab. Räikälä near Imatra Falls, (SE), leg. Hj. Hjelt. — Pl. 3 fig. 51.

A. glaucescens Wittr., Gotl. och Öl. pl. 4 f. 11; West, Madagascar p. 86 pl. 9 f. 37; Printz, Beitr. Norweg. Pl. 3 f. 66—79. Long. 4,6, lat. 5,3 μ . [N:o 1068].

The general proportions well agree with those of *A. glaucesceus* although its size is but one third of the measures given by Wittrock. It seems to be a very doubtful question whether this species is a desmid at all or perhaps a *Tetraëdron*. It is by no means impossible, that there are two species, very like each other, as maintained by Dr Borge: one *Arthrodesmus* and one *Tetraëdron*. The cells under my observation were most probably an *Arthrodesmus*.

Hab. — (SW?), leg. Elfv. — Pl. 3 fig. 54—55.

A. convergens Ehr. var. *incrassatus* Gutw. Forma spinis longis rectis divergentibus, membrana in cellulis a latere visis conspicue incrassata. Long. 42, lat. cum spin. 74, lat. sine sp. 42, isthm. 9,5, crass. 22, long. spinæ 16 μ . Compare also Borge, Süssw. Chlor. Archang. pl. 3 f. 35. [N:o 843].

Hab. Gov. of Archangel. — Pl. 3 fig. 52—53.

A. octocornis Ehr. Forma spinis inferioribus brevioribus, superioribus plus, horizontaliter dispositis, apice minus concavo. Cum spin. long. 34, lat. 34 μ . [N:o 1066].

Hab. Karkku (W), leg. Hj. Hjelt. — Pl. 3 fig. 56—57.

A. impar (Jacobs.) nob. (Synon. = *Xanth. octocorne* f. *impar* Jacobs., Desm. Danem. pl. 8 f. 28) Cellulae parvae medio incisura introrsum non acuta profunde constrictae. Semicellulae trapeziformes lateribus et apice valde excavatis, angulis quasi productis inflatisque et spinis singulis (vel interdum geminatis) longis firmis oblique sursum directis instructis; a vertice visae depresso ellipticae medio nec protuberantia nec incrassatione ulla. Cum. spin. long. 76—80, lat. 76—80, sine spin. long. 42—49, lat. 34—42 isthm. 10—13, crass. 19, long. spin. max. 23 μ . [N:o 761].

West has suggested the relationship between Jacobsen's form and *X. smithii* (Vide Mngr. IV page 113). Again, the Karelian form, which seemed to agree very well with Jacobsen's description and figure, is doubtless an *Arthrodesmus*: the central area in the semicells is always undifferentiated and the spines are normally unpaired. It

is easily distinguished from *A. octocornis* by its size, which is twice as large, the submamillate angles and the very different sinus. Also *X. smithii* var. *majus* (Ralfs) West is smaller with shorter and normally paired spines, with a thickened central area and a different shape of its semicells.

Hab. Gov. of Archangel. — Pl. 3 fig. 58—60.

Genus *Staurastrum* Meyen.

S. pachyrhynchum Nordst. var. *uhtuense* nova var. Cellulae a fronte visae dorso altius convexo, membrana etiam in apice incrassata; a vertice visae triangulae lateribus subrectis (vix conspicue retusis), angulis plus obtusis. Massa chlorophyllacea axilis nucleis singulis. Membrana subtilissime porosa. Long. 35, lat. 30, isthm. 11 μ . [N:o 842].

Hab. Gov. of Archangel. — Pl. 3 fig. 44—45.

S. minutissimum Reinsch. var. *convexum* West, Mngr. IV p. 131 pl. 119 f. 3 (syn. = *S. minutissimum* Reinsch., Spec. gen. alg. nov. pl. 23 A II fig. 1—2); Boldt, Desm. Grönl. pl. II f. 41. — The Finnish specimens have in vertical view less retuse sides. Long. 14,5—11,9—13,2—13,2, lat. 14,5—13,9—14,5, 13,9, isthm. 11—11,9—11,1—11,1 μ . [N:o 1091].

Hab. Nådendal (SW), leg. Elfv. — Pl. 3 fig. 41—43.

S. tristichum Elfv. This species seems to be exceedingly rare, not being recorded since it was described for the first time (Cfr. Nordst., Index & Suppl.). Our drawings are made from a specimen in a sample from Prof. Elfving's collection. In the front view the sinus is deeper and also more rounded (not acute) than according to Elfving's figure. Nevertheless I think this is nothing but the typical *S. tristichum*. It is closely allied to „*S. pygmaeum* Brèb. forma 4-gona“ Boldt (Desm. Grönl. pl. 2 f. 42). Compare also *S. pygmaeum* v. *subglabrum* Boldt (Sibir. Chlor. pl. 5 f. 20); *S. pygm.* v. *subglabr.* forma Eichler

Pamietn. Fiz. XIV pl. 4 f. 44). — Long. 36—38, lat. 34—38 isthm. 16—17 μ . [N:o 1087].

Hab. Nådendal, (SW), leg. Elfv. — Pl. 5 fig. 1—2.

S. scabrum Bréb. (sensu West, Frw. alg. N.-Irel. pl. 2 f. 36). Zygospora anguloso-globosa, in angulis spinis 2—3 apice 2—3 furcatis armata. Diam. zygosp. c. spin. 42 μ . — Cfr. Roy & Biss., Scott. Desm. p. 242. [N:o 862].

Hab. Esbo, (S) leg. C. Cz. — Pl. 5 fig. 16.

S. geminatum Nordst., Sydl. Norg. fig. 13, var. **heteracanthum**, nova var. Semicellulae a fronte visae subtriangulares, sinu valde dilatato et lateribus rectis, angulis (seu polis) oblique truncatis spinis binis longis firmis instructis, apice subrecto vel vix conspicue convexo. Spinae omnes geminatae: binae in unoquoque angulo et 4 (bis binae) in unoquoque latere. Spinae angulorum maiores (praecipue superiores), spinae laterales minores (praecipue inferiores). A vertice visum triangulum lateribus conspicue retusis, angulis rotundatis; spinae in ipso margine 9 totidemque infra margines. Cum spin. long. 57—46, lat. 53—49; sine spin. long. 32—30, lat. 27—27, isthm. 11—9, long. spin. max. 14 μ . [N:o 791].

This variety is distinguished by its subtriangulate semicells and the widely open sinus. The spines at the angles are thicker and longer than the others, thus very much resembling *S. setigerum* Cleve (Comp. *S. setig.* v. *occidentale* West, N.-Amer. pl. 16 f. 27).

Hab. Gov. of Archangel. — Pl. 5 fig. 13—15.

S. forficulatum Lund. var. **subheteroplophorum** Grönbl., Desm. Keur. pl. 3 f. 51—52. A new drawing was made because the earlier was not a good one. Cum spin. long. 57, lat. 64, isthm. 14 μ . [N:o 729].

Hab. Lempäälä (W). — Pl. 5 fig. 3—4.

— — forma **simplex** nova f. Cellulae a vertice visae lateribus vix retusis vel fere rectis, marginibus glabris, angulis productis. Cum spin. long. 64, lat. 76, isthm. 15 μ [N:o 1249].

Hab. Keuru (C). — Pl. 5 fig. 5—6.

var. **heteracanthum** Grönbl., *ibid.* pl. 1 f. 27—28. A figure of the front view will here be published. Cum spin. long. 55, lat. 61, isthm. 15 μ . [N:o 1201].

Hab. Esbo (S), leg. C. Cz. — Pl. 5 fig. 7—8.

— — forma. Ad var. *verrucosum* Grönbl. accedens. Cum spin. long. 53, lat. 64, isthm. 17 μ . [N:o 1218].

Hab. Esbo (S), leg. C. Cz. — Pl. 5 fig. 9—10.

S. cornutum Arch. A 4-angulate form was observed, very much resembling *S. forficulat.* v. *heteracanth.* These two species appear to be closely related and could perhaps be united to one. — Cum spin. long. 49, lat. 53, isthm. 17 μ . [N:o 1159].

Hab. Keuru (C). — Pl. 5 fig. 11—12.

S. cedercreutzii, nova sp. Cellulae parvae medio sinu profundo valde aperto introrsum quasi acuminato lateribus primum valde, mox minus divergentibus. Semicellulae a fronte visae crasse subfusiformes, apice convexo verrucoso, ad polos (truncatos, apice 6-granulatos) versus utrimque attenuato. Membrana seriebus granulorum longitudinalibus 8, dorso verrucis depressis, ad isthmum cingulis simplicibus granulorum ornata. A vertice visae triangulae, angulis truncatis, lateribus undulatis haud multum retusis; membrana ad angulos transversaliter granulata, medio in area triangulari glabra (circa eam in unoquoque latere verrucis 3 bi- vel trigranulatis armata. A ventre visae ad angulos transversaliter granulatae, medio glabrae circulo tantum prope isthmum ornatae. — Zygospora angulose globosa processibus brevibus apice trifurcatis armata. Long. 25—27, lat. 22—24, isthm. 8—8,5, zygospor. diam. c. proc. 38 μ . [N:o 1131].

Hab. Esbo (S), leg. C. Cz. — Pl. 5 fig. 21—23.

S. polymorphum Bréb. This species is very often mentioned in lists of desmids, but a figure in which the structure of the cell-wall clearly is to be seen has never been published. I will now publish some drawings of this species made from specimens in Wittr. & Nordst. exsicc. n:o 71. The cell-wall is finely and acutely granulate; the apices of the processes furnished with 4 short but

strong spines. Long. 28, lat. (c. spin.) 37—39, isthm. 8—9 μ . [N:o 890 b].

Pl. 5 fig. 17—20.

var. **pygmaeum**, nova var. Cellulae multo minores prae longitudine latiores. Semicellulae fusiformes angulis (= polis) non productis, anguli aculeis 3 firmis armati; granula sparsiora; a vertice visum lateribus plus retusis, angulis non productis. Long. 18, lat. 26, isthm. 5,5 μ . [N:o 890 a]. — This variety is distinguished by its smaller size and by the angles, which are not produced into processes.

Hab. Gov. of Archangel. — Pl. 5 fig. 33—34.

S. bicornis Hauptfl. var. **quadrifidum**, nova var. Forma cellularum et radiorum ut in var. *longeradiatum* Borge (Austral. p. 16 pl. 2 f. 22). Ad basim semicellarum utrimque supra isthmum verrucae singulae maiores superiusque singulae dimidio-minores, in medio semicellularum eminentia membranā incrassatā conspiciuntur. Radii longi, tenues, graciliter curvati in ipso margine subtiliter denticulati, in apice spinis 4 armati sunt. A vertice visae rhombiformes utroque polo in radios producto; membrana intra margines radiorum duabus seriebus granulorum acutorum longitudinaliter ornata; marginibus ipsis plane glabris; in parte media utrimque seriebus simplicibus verrucarum armata. Cum proc. long. 53, lat. 95; sine proc. long. 38; isthm. 9, crass. 21 μ . [N:o 849].

In agreement with Borge's variety our form likewise differs considerably from the typical one in being slenderer with a comparatively smaller basal portion and longer processes. In the vertical view only a simple row of verrucae on each side in the inflated median portion can be seen, whereas there are double rows in the type. The median inflation possesses a thickening of the cell-wall. — Compare also *S. bicornis* v. *boreale* Schmidle (Pite Lappm. p. 61 pl. 3 f. 11) and *S. pseudosebaldi* β *bicornis* Boldt (Sibir. Chlor. p. 117 pl. 6 f. 36), which latter by Schmidle was united with his variety as a „forma *sibirica* Schm.“ Also *S. paradoxum* β *fusiforme* Boldt (ibid. pl. 6 f. 37) is by Schmidle made a variety of *S. bicornis*; but as already

shown, it is a form of *S. natator* West. (Vide Grönbl. Desm. Keur.).

Hab. Gov. of Archangel. — Pl. 5 fig. 24—26.

S. uhtuense, nova sp. Cellulae mediocres, pars media („corpus“) quadrata medio incisurā parvā acutā vix apertā constricta. Semicellulae rectangulares dorso glabro vix retuso; angulis superioribus in radios longos in ipso margine denticulatos, in apice bifidos productos; lateribus excavatis, angulis basalibus verrucam utrimque ad isthmum efficientibus, praeterea verrucis 3 utrimque ad isthmum; a vertice visae fusiformes medio crassae. Cum proc. long. 72, lat. 62; sine proc. long. 15, lat. 15, isthm. 8 μ . [N:o 763].

This characteristic species has been observed only once. I know no species with which it could be confused. (Vide *S. columbetoides* West, Ceylon. pl. 22 f. 8—9).

Hab. Gov. of Archangel. — Pl. 5 fig. 30.

S. johnsonii West, var. **perpendiculatum** Grönbl., Desm. Keur. pl. 2 f. 33. Radiis graciliter sursum curvatis. Cum proc. long. 91—99, lat. 110—125, isthm. 13 μ . — In the living condition the chloroplasts were easily observed in the vertical view consisting of one pyrenoid in each semicell and 10 radiating plates: two in each process and three on both sides in the median portion. The same system of plates is present in *S. natator* West var. *boldtii* Grönbl. and *S. dimazum* (Lütke.) Grönbl. The figures will be here reproduced for comparison with each other. [N:o 897 a].

Hab. Lempäälä (W). — Pl. 5 fig. 35—35'.

S. pseudoiotanum, nova sp. Cellulae parvae, medio incisura parva obtusa aperta constrictae. Semicellulae biradiatae e basi subtrapeziformi utrimque in radios longos sensim attenuatos productae; radii in marginibus asymmetrice undulati plane glabri, apice spinulis 3 parvis ornati; a vertice visae fusiformes utrimque polis in radios productis, medio utrimque verrucis singulis parvis depressis bidentatis oratae. Long. 27, lat. 30, isthm. 7 μ . [N:o 886].

This species is perhaps nearest to *S. tetracerum* from

which it is distinguished by its smooth, undulated (not finely granulate-spinate) processes 3-furcate at the ends. Closely allied is also *S. ernstii* Bernard (Prot. Desm. Java pl. 11 f. 280—289), which, according to West (Journ. of Bot. 47 page 60), is nothing but *S. tetracerum*. Compare also *S. paradoxum* v. *tosnense* Bolochonцев (in Skorikow, Sommerplankt. Neva p. 391 c. icon.), which differs by its denticulate processes, 4-spinate at the ends and its size, which is the double. [This variety is by no means nearly related to *S. paradoxum* and should be relegated elsewhere: perhaps as a separate species, perhaps as a variety of *S. tetracerum*?].

Hab. Gov. of Archangel. — Pl. 5 fig. 36—37.

S. tetracerum (Kütz.) Ralfs, Brit. Desm. p. 137—138 pl. 23 f. 7. This species is described by Ralfs as having „processes which are entire at the apex“ and the cell-wall as being „rough with minute puncta-like granules which form transverse lines on the processes and give them a jointed appearance“. This diagnosis is probably erroneous in one respect: the apex of the processes are, as I should imagine, not entire, but furnished with similar „puncta-like granules“. As a matter of fact I have never seen and do not know any *Staurastum*-species of this group with entire ends of the processes. Perhaps the diagnosis is due to the low magnification by which Ralfs worked. (This is also Dr Borge's opinion.) — An exact information concerning the *S. tetracerum* is very difficult to get, as no good figures of this species have been published. The best course would be to examine the original specimens of Ralfs or some other classic.

var. ***biverruciferum***, nova var. Cellulae parvae, medio incisura parva obtusa aperta constrictae. Semicellulae biradiatae trapeziformes, dorso glabro concavo, angulis superioribus in radios attenuatos denticulatos denique 3-dentatos productis; lateribus denticulatis; dorso glabro leviter concavo; membrana in medio semicellularum verrucis 2 parvis ornata. A vertice visum sexangulare polis utrimque in

radios productis, angulis utrimque verruca parva instructis. Long. 24, lat. 22, crass. 6,6, isthm. 4 μ . [N:o 1084]. — In the front view this variety very much resembles *S. iotantum* v. *tortum* Teiling, Schwed. Plankt. II p. 65 fig. 15 (on page 64) which is neither figured nor described in vertical view (likewise the dimensions are not given, but, according to the figure, they should be: cum proc. long. 24, lat. 24, isthm. c. 4 μ). It does not seem to me correct that the „var. *tortum*“ is referred to *S. iotantum* Wolle-West, from which it differs by the rounded basal angles (comp. the diagnosis by West: „non rotundatis“) with 3-denticulate processes at the apex (by West „emarginatis“). Moreover Teiling's variety is biradiate, whilst the type is triradiate. The distinctive feature of Teiling's variety „circa 40° tortae“ is of no systematic value, the small biradiate (but also, 3-radiate) *Staurostra* very often being twisted at the isthmus. (Vide West, Mngr. IV page 172 „The alternation — — is of no specific importance —“). The „var. *tortum*“ is probably a form of *S. tetracerum* according to Dr Borge.

Hab. — (SW?), leg. Elfv. — Pl. 5 fig. 31—32.

(?) var. **subexcavatum**, nova var. Semicellulae parte basali multo minore, radiis longioribus marginibus denticulatis, apicibus 3-dentatis; dorso leviter excavato; a vertice visum fusiforme. Cum proc. long. 38, lat. 63, crass. 8 μ . [N:o 857]. — I am not sure whether this variety is correctly placed under *S. tetracerum*. Compare also *S. subparvulum* West, Ceylon pl. 22 f. 7; *S. excavatum* West, Madagasc. pl. 8 f. 42 and „forma“ West, Yan Yean pl. 6 f. 19.

Hab. Plankton from Vuoksen (SE), leg. K. M. Levan-der. — Pl. 5 fig. 28—29.

S. dimazum (Lütke m.) Grönbl. Note the chloroplasts! Lat. 85 μ , crass. 23 μ . [N:o 1225].

Hab. Esbo (S), leg. C. Cz. — Pl. 5 fig. 45.

S. natator West var. **boldtii** Grönbl. Note the chloroplasts! Lat. 76 μ , crass. 23 μ . [N:o 1224].

Hab. Esbo (S), leg. C. Cz. — Pl. 5 fig. 46.

Genus **Sphaerosma** Corda.

S. vertebratum (Bréb.) Ralfs; De Bary, Unters. Conj. pl. 4 f. 32—34. Our figures show the arrangement of the pores in two series across the semicell, and the vertical view, which not at all agrees with the figure of Ralfs (Brit. Desm. pl. 6 f. 1 f—g). — Long. 13, lat. 20, crass. 7, isthm. 6 μ . [N:o 1255].

Hab. Esbo (S), leg. C. Cz. — Pl. 7 fig. 69—70.

Genus **Spondylosium** Bréb.

S. pulchellum Arch., in Pritch., Infus. pl. 3 f. 10; West, Brit. Frw. alg. p. 175 fig. 67 A — and var. **bambusinoides** (Wittr.) Lund.; Wittr., Skand. Desmid. pl. 1 f. 12 page 25—26 [sub nom. $\equiv$ *S. bambusinoides* Wittr.]; Nordst., N.-Zeal. pl. 2 f. 11; Kaiser, Alg. Traunstein IV page 145 fig. 19.

Both the typical form and var. *bambusinoides* were observed in Finland. The apices were always slightly retuse. The former is characterized by: the more open sinus with regularly rounded basal angles and the length of the cells = the breadth; the latter by: the closely linear sinus, which at the end suddenly becomes widely dilated, causing an angularity of the basal angles, and the length which exceeds the breadth with $\frac{1}{4}$. These differences are, however, not constant and obviously it is not always possible to make a distinction between the two forms. Compare our figures with the original ones and also the following measurements: „f. *typica*“: long. 10,₆, lat. 8,₆, isthm. 2,₆ μ (fig. 5) [N:o 1056]; long. 9,₂, lat. 9,₂, isthm. 4 μ (fig. 6) [N:o 1204]; „var. *bambusinoides*“: long. 11,₅—9,₉—11,₂—9,₉, lat. 7,₉—8,₆—8,₆—7,₉, isthm. 3,₂—2,₆—3,₂—2,₆, crass. 3,₉ μ (fig. 7—8) [N:o 1055].

Hab. In all parts of Finland. — The type Pl. 6 fig. 5—6; the var. Pl. 6 fig. 7—8.

Genus **Hyalotheca** Ehr.

H. neglecta R a c i b., Desm. Tapakooma pl. III—IV fig. 3. Cellulae marginibus subparallelis, medio tantum levissime incrassatae („forma β “ R a c i b. l. c. page 30). A vertice visae circulares. Membrana poris sparsis (non transversaliter ordinatis), in area media plane glabra. Massa chlorophyllacea axilis pyrenoidibus singulis centralibus in utraque semicellula et laminis 3 radiatim e centro exeuntibus. Long. 33—34,₃, lat. max. (medio) 11,₉, lat. min. (apex) 10,₆ μ ; specimen alterum long. 33—37, lat. max. 12, l. min. 11,₅ μ . [N:o 888].

Hab. Gov. of Archangel. — Pl. 6 fig. 1.

H. undulata Nordst. (Synon. $\equiv$ *H. undul.* v. *producta* Turn., E.-Ind. p. 152 pl. 18 f. 15 sec. West, Ceylon, page 195). Forma apicibus vix attenuatis, abrupte truncatis angulis subrectis non rotundatis. Massa chlorophyllacea ut descripsit Nordstedt in Wittr. & Ndt. exsicc. fasc. 21 pag. 34. Ad formam Westii (l. c. pl. 22 f. 27) accedens. Long. 13,₂—14,₅, lat. 5,₃ (max.). [N:o 891].

Hab. Gov. of Archangel. — Pl. 6 fig. 10.

H. indica Turn., E.-Ind. p. 152 pl. 22 f. 17 (exclus. „b. maior“ pl. 19 f. 18. Cfr. West, Ceylon p. 195. Syn. $\equiv$ *H. dissil.* var. *hians* Wolle forma) var. *fennica*, nova var. Cellulae maiores prae latitudine longiores medio levissime tantum impressae. Massa chlorophyllacea, ut videtur, laminis 2 axilibus (utraque pyrenoidibus singulis) in utraque semicellula composita est. Long. 26,₄, lat. 15,₈ (max.), lat. 13,₂ (min.). [N:o 939].

This variety I formerly thought to be a form of *H. undulata* Ndt., but the outline of the cells and the size agree better with *H. indica*. Compare also *H. indica* var. *sparsipunctata* Grönbl., Desm. Keur. pl. 4 f. 32—33.

Hab. Gov. of Archang. — Pl. 6 fig. 11.

H. dissiliens (Smith) Bréb. var. *hians* Wolle, ad formam Borgei, Trop. u. subtrop. pl. 1 f. 4 accedens, sed minor; α) *circularis*, long. 17,₅—20,₇, lat. max. 20,₇, lat. min. 17,₃ μ ; membrana poris in series transversales utrimque 5

dispositis, inter eas in area media plane glabra [N:o 830];
 β) *bidentula*, forma membrana densissime poris subtilissimis
 sparsis ornata, medio plane glabra. Long. 19,5—20,7, lat.
 max. 20,7—21,8, lat. min. 17,2 μ . Forma altera poris minus
 dense in series transversales 5+5. Long. 14—16, 17—19,
 lat. max. 18, 19,8, lat. min. 15,8, 14,5 μ . Cfr. etiam var.
tatrica Racib., Desm. Polon. pl. 14 f. 5. [N:o 851, 896].

Hab. All forms in Gov. Archangel. — Pl. 6 fig. 9.

This species appears to be composed of numerous forms
 of various size and outline. The different varieties, which
 are founded upon the outline of the cells, as f. *typica*, var.
hians and v. *tatrica*, all include „formae *circulares*, *bidentulae*,
tridentulae“. Therefore I do not think it possible to separate
 these „forms“ as systematical varieties, but merely as ana-
 logous forms of the 2—3—4—5—6-radiate *Staurostra*.

Genus *Desmidium* Ag.

D. baileyi (Ralfs) De Bary var. *coelatum* (Kirchn.)
 Nordst., N.-Zeal. p. 27 pl. 2 f. 6—7. A vertice visum
 quadrangulum marginibus levissime sed conspicue retusis,
 angulis rotundatis, processibus connexis angustissime cuneatis-
 rimaeformibus. Long. (incl. proc.) 16, lat. max. 21—23, lat.
 min. (apex) 19 μ . [N:o 960 b]. — Cfr. Turner, E.-Ind.
 pag. 148.

Hab. Messuby (W). — Pl. 5 fig. 27.

Genus *Gymnozyga* Ehr.

G. confervacea West, N.-Amer. pl. 12 f. 20—21; Grön-
 blad, Desm. Keur. pl. 4 f. 31. Long. 20—25—27, lat. max.
 11,5—12,6—11,5, lat. min. (apex) 10—10,6—10,2 μ . [N:o 838,
 1214].

Hab. Keuru (C); Gov. of Archangel. — Pl. 6 fig. 2—4.

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Explanation of the plates I—VII.

Plate I.

- Fig. 1—3 *Microsterias decedentata* (Näg) Arch. $\times \frac{890}{1}$
- „ 4 *M. truncata* (Corda) Bréb. A monstrous semicell; the other one was quite normal. [N:o 1109 b] $\times \frac{530}{1}$
- „ 5, 8, 11 *M. truncata*. Two cells from a sample which was cultivated in a glass bottle several months. Originally most of the cells were quite normal, but gradually the number of abnormal cells increased very considerably, the lateral lobes not being subdivided in either of the semicells. Those individuals are almost identical with „*M. neodamensis* Braun“. Compare Pl. III fig. 61—62. — Fig. 5 [N:o 1208 a]; fig. 8 [N:o 1221 a]; fig. 11 [N:o 1208 a].
- „ 6 *M. truncata* var. *semiradiata* (Kütz.) Cleve. From Wittr. & Nordst. exs. n:o 373. $\times \frac{530}{1}$
- „ 7 *M. truncata* var. *crenata* (Bréb.) Reinsch [N:o 809 c] $\times \frac{530}{1}$
- „ 8 Vide fig. 5!
- „ 9—10 *M. truncata* var. *quadrata* Bulnh. $\times \frac{530}{1}$
- „ 11 Vide fig. 5!
- „ 12 *M. radiata* Hass., a monstrous semicell; the other was normal. $\times \frac{530}{1}$
- „ 13 *M. murrayi* West $\times \frac{530}{1}$
- „ 14 *M. quadridentata* (Nordst.) Grönl. From Wittr. & Nordst. exsicc. n:o 371. 14 $\times \frac{530}{1}$; 14' $\times \frac{890}{1}$
- „ 15 *M. rotata* (Grev.) Ralfs f. *pseudoquadridentata* nova f. $\times \frac{530}{1}$

- Fig. 16 *M. crux melitensis* (Ehr.) Hass. forma ad var. *protuberans* Grönl. $\times \frac{530}{1}$
 „ 17—18 *M. rotata* forma ad f. *evoluta* Turn. 17 $\times \frac{1460}{1}$; 18
 $\times \frac{530}{1}$

Plate II.

- Fig. 1 *Microsterias rotata* f. *evoluta* Turn. Vertical view. $\times \frac{530}{1}$
 „ 2 „ „ type. Vert. view. $\times \frac{530}{1}$
 „ 3 *M. denticulata* Bréb. var. *intermedia* Nordst. From Wittr. & Nordst. exicc. n:o 370. The characteristic margins.
 „ 4—5 *M. angulosa* Hantzsch. Fig. 5 from Wittr. & Nordst. exsicc. n:o 1454 a. $\times \frac{530}{1}$
 „ 6—7 *M. denticulata* Bréb., type. $\times \frac{530}{1}$
 „ 8—9 *M. thomasiana* Arch. f. $\times \frac{890}{1}$
 „ 10—11 *Euastrum boldtii* Schm. Two forms. $\times \frac{890}{1}$
 „ 12—13 *E. elegans* var. *ornatum* West. $\times \frac{1460}{1}$
 „ 14—15 *E. lapponicum* Schm. $\times \frac{890}{1}$
 „ 16 *E. turneri* f. *fennica* nova f. $\times \frac{1460}{1}$
 „ 17—19 *E. dubium* var. *pseudocambrense* Grönl. $\times \frac{1460}{1}$
 „ 20—21 *E. insulare* var. *excavatum* nova var. $\times \frac{1260}{1}$
 „ 22—23 *E. turneri* var. *karelicum* nova var. $\times \frac{550}{1}$

Plate III.

- Fig. 1—4 *Euastrum boldtii* var. *isthmochondrum*, nova var. 1—2
 A form with three granules at the central protuberance;
 3—4 another form with an emarginate central papilla. $\times \frac{1460}{1}$
 „ 5—7 *E. pseudoboldtii* nova sp. $\times \frac{1460}{1}$
 „ 8—9 *E. denticulatum* (Kirchn.) Gay. Forma. $\times \frac{1260}{1}$
 „ 10—11 „ „ var. *angusticeps*, nova var. $\times \frac{1460}{1}$
 „ 12—13 and 14—15 *E. gayanum* De Toni. Two individuals.
 $\times \frac{1460}{1}$
 „ 16 and 19 *E. sibiricum* f. *exsecta*, nova f. 16 $\times \frac{1460}{1}$; 19
 $\times \frac{1260}{1}$
 „ 17—18 *E. sibiricum* f. *fennica*, nova f. $\times \frac{1460}{1}$

- Fig. 20—21 *E. binale* (Turp.) Ehr. Forma. $\times \frac{1460}{1}$
 „ 22—23 „ „ Forma. $\times \frac{1460}{1}$
 „ 24—25 „ „ var. *pseudogutwinskii*, nova var. $\times \frac{890}{1}$
 „ 26 *E. bidentatum* f. *biscrobiculata* Ducell. $\times \frac{530}{1}$
 „ 27—28 *E. pulchellum* var. *subabruptum*, nova var. $\times \frac{1460}{1}$
 „ 29—30 *E. verrucosum* var. *subplanctonicum* nova var. $\times \frac{530}{1}$
 „ 31—32 *E. spec.* (monstruosa cellula?) $\times \frac{530}{1}$
 „ 33—34 *E. mononcyllum* var. *polonicum* Racib. f. *fennica*, nova
 f. 33 $\times \frac{530}{1}$; 34 $\times \frac{1460}{1}$
 „ 35 *E. insigne* Hass. Forma. $\times \frac{530}{1}$
 „ 36 *E. didelta* (Turp.) Ralfs. Forma. $\times \frac{530}{1}$
 „ 37—38 *E. securiformiceps* Borge $\times \frac{530}{1}$
 „ 39—40 *E. aboense* Elfv. $\times \frac{530}{1}$
 „ 41—43 *Staurostrum minutissimum* Reinsch var. *convexum*
 West; 41 and 43 front view, 42 vertical view. $\times \frac{1460}{1}$
 „ 44—45 *S. pachyrhynchum* Nordst. var. *uhtuense*, nova var
 $\times \frac{530}{1}$
 „ 46 *Xanthidium cristatum* var. *uncinatum* Bréb. f. *longispina*,
 nova f. $\times \frac{530}{1}$
 „ 47—48 *X. cristatum* var. *dimazum* Grönbl. $\times \frac{530}{1}$
 „ 49—50 *X. cristatum*, forma ad *X. mayori*. $\times \text{circ. } \frac{350}{1}$
 „ 51 *Arthrodesmus curvatus* var. *imatrensis* nova var. $\times \frac{530}{1}$
 „ 52—53 *A. convergens* var. *incrassatus* Gutw. Forma. $\times \frac{530}{1}$
 „ 54—55 *A. glaucescens* Wittr. $\times \frac{2420}{1}$
 „ 56—57 *A. octocornis* Ehr. Forma. The one semicell in fig.
 57 without basal spines thus resembling *A. incus*. $\times \frac{530}{1}$
 „ 58—60 *A. impar* (Jacobs.) nob. 58 $\times \frac{530}{1}$; 59—60 $\times \text{circ. } \frac{530}{1}$
 „ 61—62 *Micrasterias truncata*, forma. The drawings are
 made from specimens distributed in Rabenhorst's exicc. n:o
 508 by Mr. Itzigsohn as „*M. Neodamensis* A. Br.“ Later
 he suggested it to be *M. Itzigsohnii* Braun. $\times \frac{530}{1}$

Plate IV.

Fig. 1—2, 3, 4—5 and 6—7 *Xanthidium antilopæum* (Bréb.) Kütz.
 Various forms which belong to the „f. *typica*“. Fig. 6—7

is the same form as figured by West (Mngr. IV pl. 108 f. 18). All figs. $\times \frac{530}{1}$

- Fig. 8 — — var. *triquetrum* Lund. $\times \frac{530}{1}$
 „ 9—14 — — var. *dimazum* Nordst. Fig. 9 with unpaired apical spines; 10—11 with all spines paired; 12 one semi-cell monstrous without apical spines; 13 and 14 more different forms. Fig 14 $\times$ circ. $\frac{530}{1}$, all others $\times \frac{530}{1}$
 „ 15—16 — — var. *minneapolisense* Wolle $\times \frac{530}{1}$
 „ 17—18 — — var. *basiornatum* Eichl. & Racib.; 17 $\times$ circ. $\frac{350}{1}$; 18 $\times$ circ. $\frac{300}{1}$
 „ 19—20 — — var. *laeve* Schm. f. *incrassata*, nova f. $\times \frac{530}{1}$
 „ 21—22 — — var. *oligacanthum* Schm. $\times \frac{530}{1}$
 „ 23—24 — — var. *hebridarum* West $\times \frac{530}{1}$
 „ 25—27 *X. fasciculatum* var. *longispinum*, nova var. $\times \frac{530}{1}$
 „ 28—29 *X. antilop.* var. *crameri* nov. nom. $\times \frac{530}{1}$
 „ 30—31 — — var. *ornatum* Anderss., 30 $\times \frac{530}{1}$; 31 $\times$ circ. $\frac{350}{1}$
 „ 32—33 *X. pseudobengalicum*, nova spec. $\times \frac{530}{1}$
 „ 34—35 *X. tetracentrotum* f. *protuberans* West $\times \frac{530}{1}$
 „ 36 *X. cristatum* var. *uncinatum* Bréb., forma. $\times \frac{530}{1}$
 „ 37 *X. cristatum* f. *polonica* Gutw. A form with small accessory spines. $\times \frac{530}{1}$
 „ 38 *X. fasciculatum* var. *oronense* West. $\times \frac{530}{1}$

Plate V.

- Fig. 1—2 *Staurostrum tristichum* Elfv. $\times \frac{1460}{1}$
 „ 3—4 *S. forficulatum* var. *subheteroplophorum* Grönbl. $\times \frac{530}{1}$
 „ 5—6 — — var. *subheteropl.* f. *simplex*, nova f. $\times \frac{530}{1}$
 „ 7—8 — — var. *heteracanthum* Grönbl. $\times \frac{530}{1}$
 „ 9—10 — — „ „ Forma ad var. *verrucosum* $\times \frac{530}{1}$
 „ 11—12 *S. cornutum* Arch. $\times \frac{530}{1}$
 „ 13—15 *S. geminatum* var. *heteracanthum* nova var. $\times \frac{530}{1}$
 „ 16 Zygospore of *S. scabrum* Bréb. $\times \frac{530}{1}$
 „ 17—20 *S. polymorphum* Bréb. From Witttr. & Nordst. exsicc. n:o 71. $\times \frac{890}{1}$
 „ 21—23 *S. cedercreutzii*, nova spec. $\times \frac{1460}{1}$

- Fig. 24—26 *S. bicornis* Hauptfl. var. *quadrifidum*, nova var. $\times \frac{530}{1}$
- „ 27 *Desmidium baileyi* var. *caelatum* (Kirchn.) Nordst. $\times \frac{1460}{1}$
- „ 28—29 *S. tetracerum* (?) var. *subexcavatum* nova var. $\times \frac{530}{1}$
- „ 30 *S. uhtuense*, nova spec. $\times$ circ. $\frac{700}{1}$
- „ 31—32 *S. tetracerum* var. *biverruciferum*, nova var. $\times \frac{1460}{1}$
- „ 33—34 *S. polymorphum* var. *pygmaeum* nova var. $\times \frac{1460}{1}$
- „ 35—35' *S. johnsonii* var. *perpendicularatum*. Fig. 35' is a schematic sketch of the chloroplasts from the vertical view. $\times \frac{530}{1}$
- „ 36—37 *S. pseudoiotanum*, nova sp. $\times \frac{1460}{1}$
- „ 38—41 *Closterium tumidum* var. *nylandicum* nova var. 38—39 two zygospores, 40 side view of zygospore, 41 vegetative cell. $\times \frac{530}{1}$
- „ 42 *Cl. pseudolunula* Borge f. $\times \frac{530}{1}$
- „ 43 *Cl. spetsbergense* var. *laticeps* nova var. $\times \frac{530}{1}$
- „ 44 Zygospore of *Cl. rostratum* (abnormal.). $\times \frac{530}{1}$
- „ 45 *Staur. dimazum* (Lütkem.) Grönbl. Vertical view with chloroplasts. $\times \frac{530}{1}$
- „ 46 *S. natator* var. *boldtii* Grönbl. Vertical view with chloroplasts. $\times \frac{530}{1}$

Plate VI.

- Fig. 1 *Hyalotheca neglecta* Racib. $\times \frac{1460}{1}$
- „ 2—4 *Gymnozyga confervacea* West. 2 $\times \frac{1460}{1}$; 3 and 4 showing the cell division. $\times \frac{890}{1}$
- „ 5—6 *Spondylosium pulchellum* Arch., type. $\times \frac{1460}{1}$
- „ 7—8 — — var. *bambusinoides* (Wittr.) Lund. $\times \frac{1460}{1}$
- „ 9 *Hyaloth. dissiliens* var. *hians* Wolle $\times \frac{890}{1}$
- „ 10 *H. undulata* Nordst. Forma $\times \frac{1460}{1}$
- „ 11 *H. indica* var. *fennica*, nova var. $\times \frac{1460}{1}$
- „ 12—13 *Cosmarium cedercreutzii*, nova spec. $\times \frac{1460}{1}$
- „ 14—15 *C. calamistratum*, nova spec. $\times \frac{1460}{1}$
- „ 16—17 *C. blyttii* var. *pseudorichmondiae*, nova var. $\times \frac{1460}{1}$
- „ 18—19 *C. abscissum* nova spec. $\times \frac{890}{1}$

Fig. 20—21 and 30 — — var. *subetchachanense*, nova var. 20—

21 $\times \frac{530}{1}$; 30 $\times \frac{1460}{1}$

„ 22—23 *C. pseudopromontorium* nova spec. $\times \frac{1460}{1}$

„ 24—25 *C. sexnotatum* var. *denotatum* nova var. $\frac{890}{1}$

„ 26—27 *C. perincisum* novum nom. $\times \frac{530}{1}$

„ 28—29 *C. cymatopleurum* var. *tyrolicum* Nordst. Forma.

$\frac{530}{1}$

„ 30 (vide 20!)

„ 31—34 *C. ceratophorum* Lütkem. Forma. $\times \frac{890}{1}$

„ 35—37 *C. miraculum* nova spec. 35—36 $\times \frac{530}{1}$; 37

$\frac{1460}{1}$

„ 38—39 *C. malinvernianum* (Racib.) Schmidle $\times \frac{530}{1}$

„ 40—42 *C. magnificum* Nordst. Forma. $\times \frac{530}{1}$

Plate VII.

Fig. 1—3 *Cosmarium rectangulare* var. *eichlerianum* nov. nom.

„ 4—6 *C. tetrachondrum* Lund. Forma. $\times \frac{530}{1}$

„ 7 and 8—9 *C. abbreviatum* f. *germanica* Racib. $\times \frac{1460}{1}$

„ 10—12 *C. novae-semiliae* var. *sibericum* Boldt. $\times \frac{1460}{1}$

„ 13—14 *C. venustum* var. *laticeps*, nova var. $\times \frac{1460}{1}$

„ 15—16 *C. tinctum* var. *tumidum* Borge f. $\times \frac{1460}{1}$

„ 17—18 *C. venustum* var. *excavatum* West. Forma. $\times \frac{890}{1}$

„ 19—20 *C. pygmaeum* var. *atumidum*, nova var. $\times \frac{1460}{1}$

„ 21—23 *C. pseudoretusiforme*, nova spec. 21 $\times \frac{2420}{1}$; 22—23

$\times \frac{1460}{1}$

„ 24—26 *C. polygonum* var. *hexagonum*, nova var. $\times \frac{1460}{1}$

„ 27—27' *C. sphagnicolum* var. *incisum*, nova var. $\times \frac{2420}{1}$

„ 28—29 *C. angulosum* var. *tumescens*, nova var. $\times \frac{1460}{1}$

„ 30—31 *C. angulosum* var. *scrobiculatum*, nova var. $\times \frac{1460}{1}$

„ 32—33 *C. gostyniense* (Racib.) nob. $\times \frac{1460}{1}$

„ 34—37 *C. subtile* (West) Lütkem. var. *subsparsopunctatum*

nova var. $\times \frac{1460}{1}$

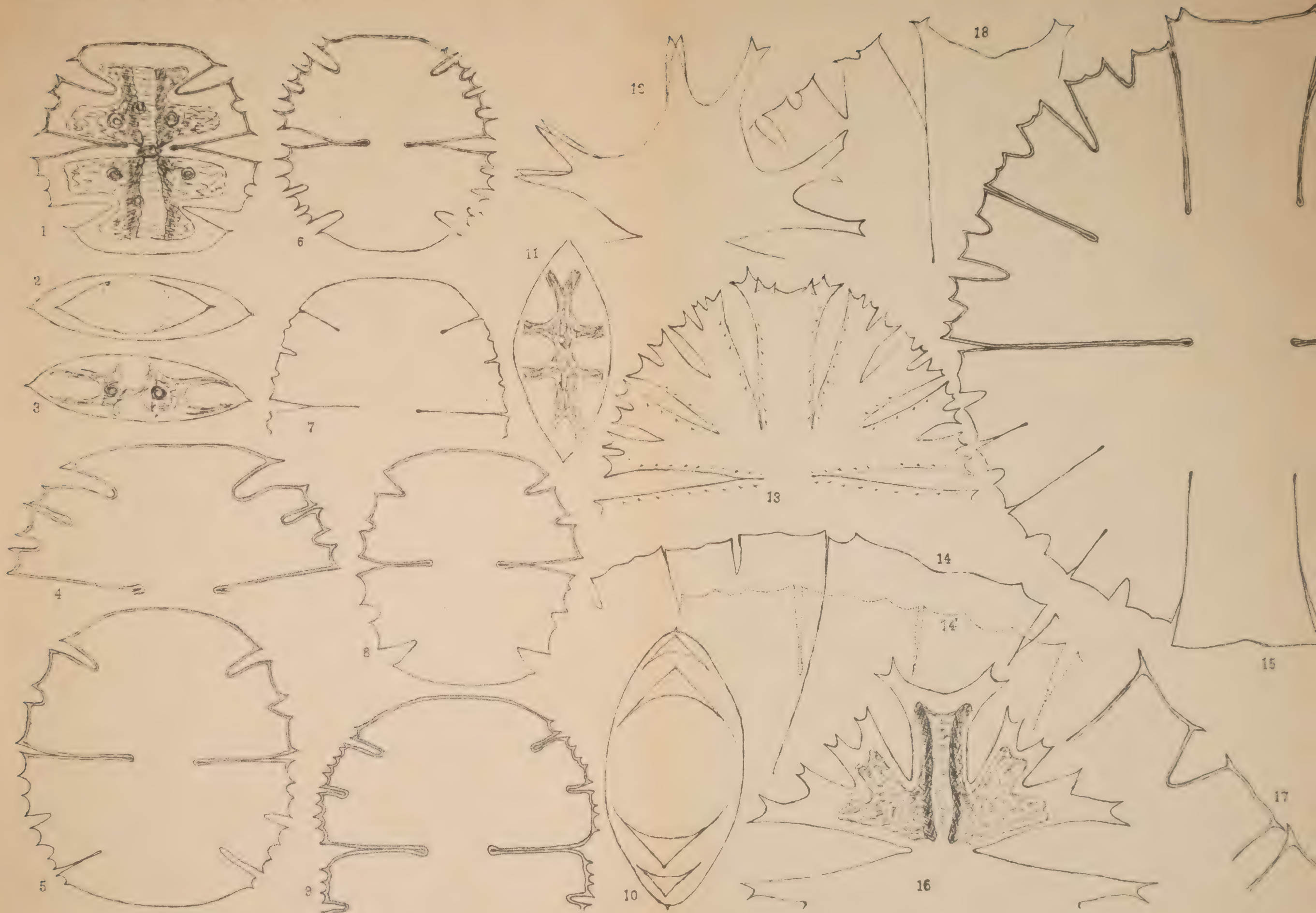
„ 38 *C. bacillare* Lütkem. $\times \frac{1460}{1}$

„ 39—41 *C. perminutum* West $\times \frac{1460}{1}$

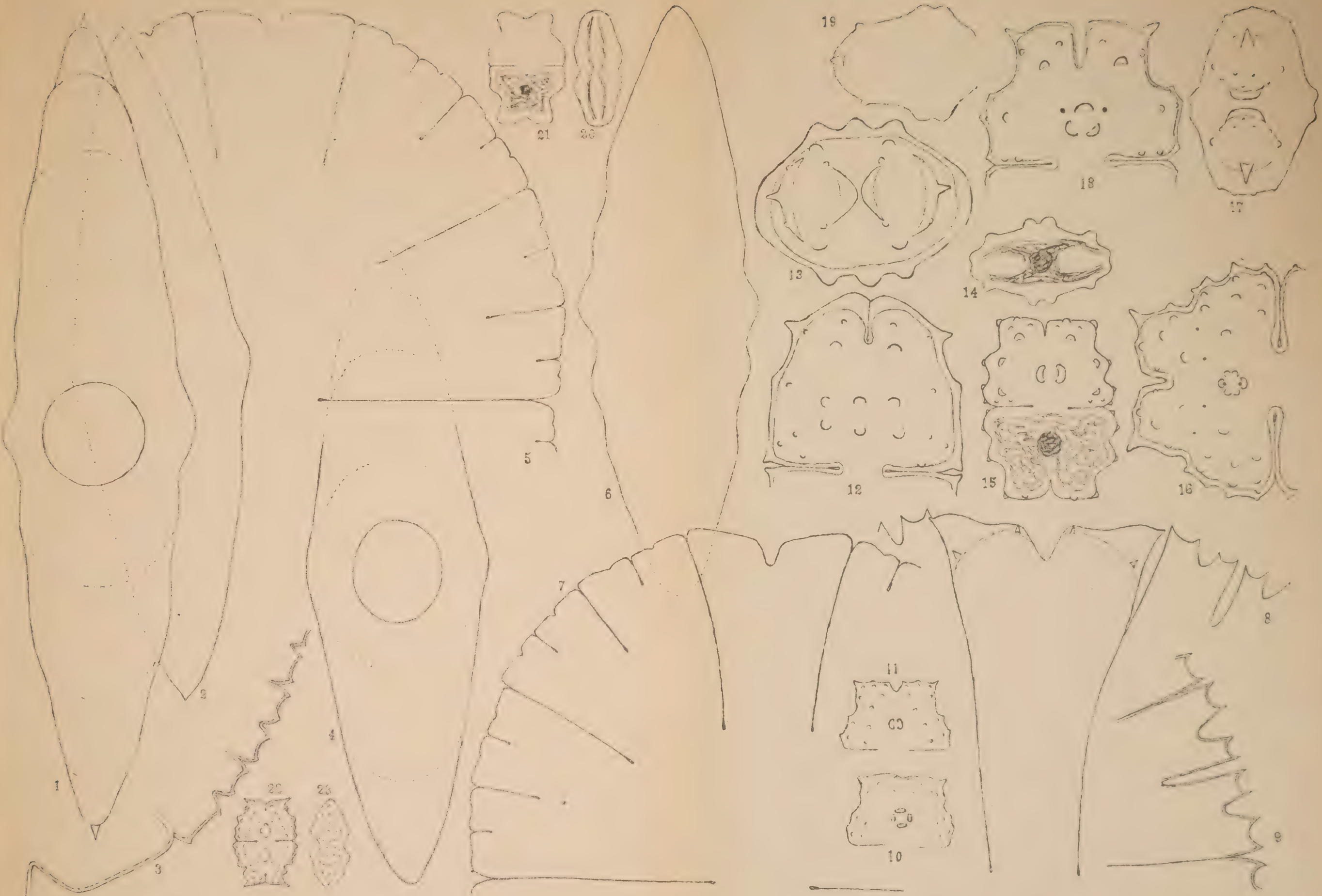
„ 42—44 *C. angulare* var. *bicostotum*, nova var. $\times \frac{530}{1}$

„ 45—46 *C. miedzyrzecense* var. *monomazum* nova var. $\times \frac{1460}{1}$

- Fig. 47—48 *C. pseudooctangulare*, nova spec. $\times \frac{1460}{1}$
 „ 49—50 *C. regnellii* Wille $\times \frac{1460}{1}$
 „ 51—52 *C. meneghinii* Bréb. $\times \frac{1460}{1}$
 „ 53—54 *C. quadratulum* var. *sublobatiforme*, nova var. $\times \frac{1460}{1}$
 „ 55—56 and 57 *C. regnellii* var. *minimum* Eichl. & Gutw. $\times \frac{1460}{1}$
 „ 58—60 *C. obsoletum* (Hantzsch) Reinsch 58—59 $\frac{530}{1}$; 60 $\times \frac{1460}{1}$
 „ 61 *C. pseudotinecense*, nova spec. $\times \frac{530}{1}$
 „ 62 *C. cucurbitinum* var. *grande*, nova var. $\times \frac{530}{1}$
 „ 63 *C. cucurbita* Bréb., zygosporé $\times \frac{400}{1}$
 „ 64—66 *C. turpinii* var. *eximium* West $\times \frac{530}{1}$
 „ 67—68 *C. enontekiense* nova spec. $\times \frac{1460}{1}$
 „ 69—70 *Sphaerosoma vertebratum* (Bréb.) Ralfs. $\times \frac{1460}{1}$
 „ 71—73 *Xanthidium concinnum* var. *varians*, nova var. $\times \frac{1460}{1}$



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